University Of Alberta
0 0004 77453 93

Digitized by the Internet Archive
in 2021 with funding from
University of Alberta Libraries

https://archive.org/details/canadianlandscap00blai

Simone

THE CANADIAN LANDSCAPE

Map and Air Photo Interpretation

THE CANADIAN LANDSCAPE

Map and Air Photo Interpretation

C. L. BLAIR, M.A.
Master,
Sheridan College of Applied Arts and Technology

R. I. SIMPSON, M.A., F.R.G.S.,
Head, Geography Department,
Winston Churchill Collegiate Institute,
Scarborough

THE COPP CLARK PUBLISHING COMPANY / TORONTO

ACKNOWLEDGEMENTS

The Authors are indebted to the following for supplying photographs for reproduction.

The Air Photo Division, Department of Energy, Mines and Resources, Ottawa, for the photographs on pp. 19, 21, 29, 30, 31, 35, 37, 38, 46, 52, 53, 54, 62, 69, 70, 75, 76, 79, 80, 83, 84, 87, 88, 89, 90, 93, 97, 98, 99, 100, 104, 105, 109, 110, 113, 114, 119, 124, 125, 134, 135, 144, 145, 146, 150. (Canadian Government copyright.)

Canadian National Railways for the photographs on pp. 57, 61, 115, 116, 126, 132, 133, 136, 141.

Canadian Pacific Railways for the photographs on pp. 36, 39, 45, 49, 50, 51, 74, 94, 131.

Lockwood Survey Corporation, Toronto, for the photographs on pp. 13, 14, 18, 142.

The Aluminum Co. of Canada for the photographs on pp. 120 and 123.

The Toronto Star for the photographs on pp. 143 and 154.

Metropolitan Toronto and Region Conservation Authority for the photographs on p. 153.

Jack Mitchell, Toronto, for the photograph on p. 149.

Great Britain, Ministry of Defence (Air Force Department) for the photographs on pp. 157 and 158 (British copyright reserved).

British Overseas Airways Corporation for the photographs on pp. 159 and 160.

Institut Géographique National, France, for the photographs on pp. 169 and 170.

Jules Richard, Paris, for the photograph on p. 171.

[1538]

© Copyright, 1967, by the Copp Clark Publishing Company.

PREFACE

The purpose of this book is to teach both reading and interpretation of topographic maps and aerial photographs.

Three introductory chapters give a thorough grounding in the principles of map reading, the identification of objects from aerial photographs, and the interpretation of facts derived from both maps and photographs.

Following these chapters are a number of full-colour, Canadian topographic maps (with two foreign maps at the end of the book). Wherever possible aerial photographs of appropriate parts of each map have been included. The exercises with each group of map and photographs are designed to lead the student from simple map reading through interpretation to making his own analysis of a geographic region, and the descriptive notes of the regions covered by the first two maps (Wolfville and Montreal) are intended to serve the student as models for his geographical analyses of subsequent maps. The questions in each assignment are not exhaustive, and the teacher has been left to request a written geographical account of a region only where he feels it is appropriate. Not all questions need be assigned for each region under study.

The authors have attempted to provide a selection of maps to permit varied studies of urban regions, of landforms, of human geography and economic activities, and of climatic factors.

The authors wish to acknowledge the co-operation of many employees of the National Air Photograph Library and the Map Distribution Office of the Department of Energy, Mines and Resources, Ottawa; of Mr. J. Houghton, who drew the diagrams for the introductory chapters, of Mr. W. J. Dey of the photography department, and of Mrs. T. Crawley of the editorial department of the Copp Clark Publishing Company.

C. L. B.
R. I. S.

CONTENTS

Map Reading 1

Air Photographs 13

The Interpretation of Maps and Aerial Photographs . 23

Introductory Studies

Wolfville 29

Montreal 35

Landforms: Glaciation

Lake Louise 45

Orillia 52

Mount Revelstoke 58

Landforms: Coastlines

Lunenburg 61

Nootka-Nanaimo 66

Landforms: Rivers

Loretta Canyon 69

Peace River 74

Medicine Hat 79

Fort Resolution 84

Rosyth 88

Landforms: Arid Lands

Vernon 93

Crane Lake 99

Landforms: Scarplands

Grimsby 104

Mining and Industry

Thetford 109

Quetico 113

Arvida 119

Urban Studies

Winnipeg 124

Vancouver 132

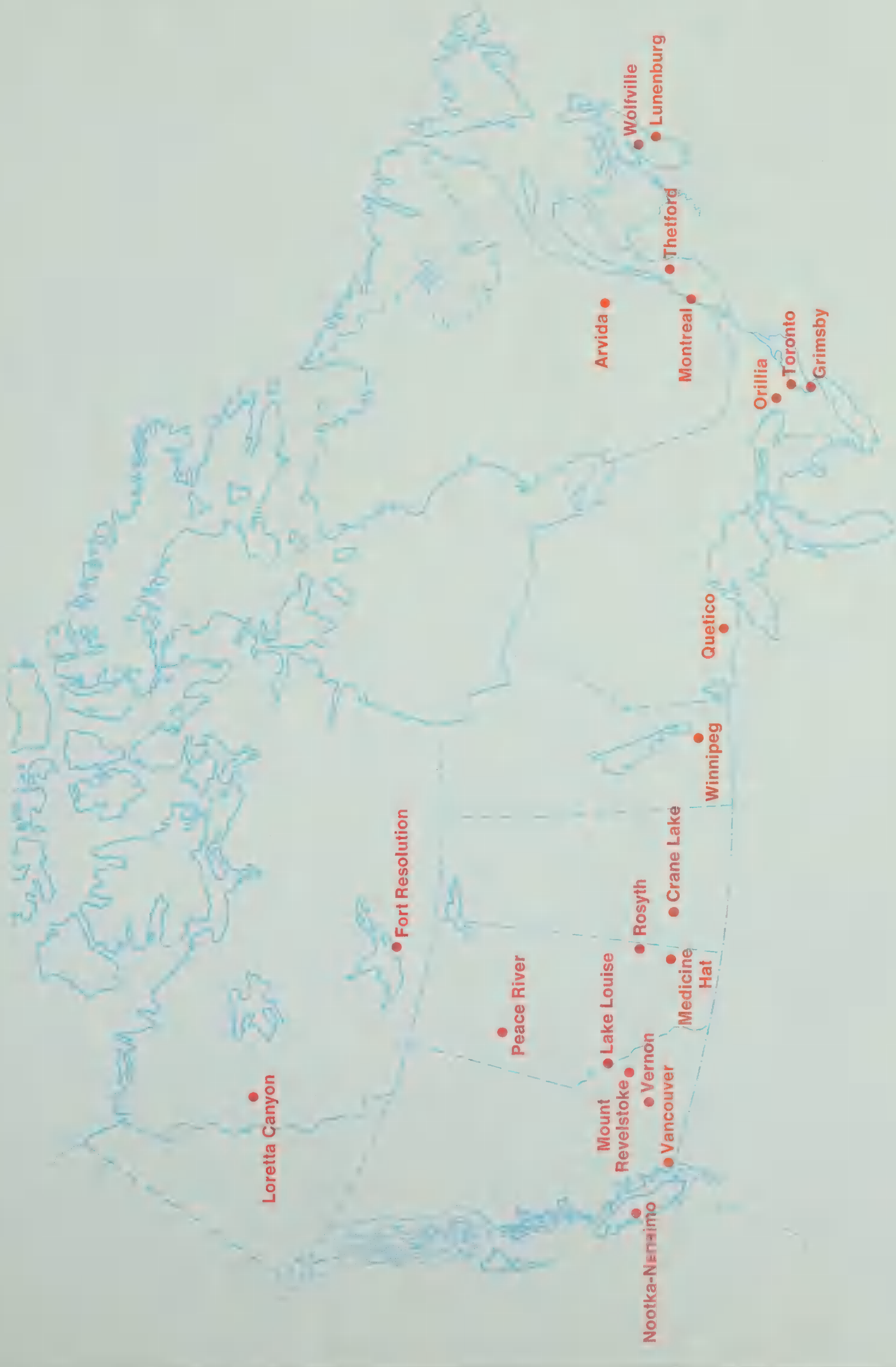
Toronto 142

Foreign Maps

London 157

Paris 166

LOCATION OF CANADIAN MAPS


Nootka-Nanaimo
Vancouver
Mount Revelstoke
Vernon
Lake Louise
Medicine Hat
Loretta Canyon
Peace River
Rosyth
Crane Lake
Fort Resolution
Winnipeg
Quetico
Orillia
Toronto
Grimsby
Montreal
Arvida
Thetford
Wolfville
Lunenburg

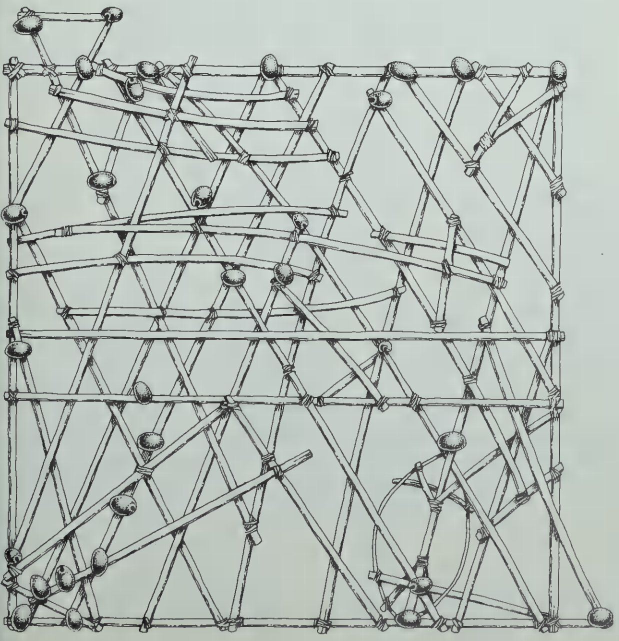
MAP READING

One of the main concerns of the geographer is the spatial relationships of geographical phenomena, and he uses maps to show the distribution of geographical factors and to examine the relationships between factors. Cartography (the study of map-making), map reading and map interpretation are therefore among the most important aspects of geography. Many other scientists, such as geologists, archaeologists, botanists, agronomists, and economists, also use maps in their work, and it is necessary for them to have a working knowledge of map reading and map interpretation.

Cartography

Maps are the oldest written language in the world; long before any spoken language was developed into a written form, primitive man made maps and used them on his voyages. The early Asians, Africans, North and South Americans made sketch maps out of materials such as sand, stone, bark, wood, skins of animals, clay tablets and even pieces of bamboo.

One of the most treasured possessions of the early Micronesians was the stick chart pictured below, the interpretation of which was a carefully guarded secret passed from father to son. The position of islands (indicated by shells) was fixed by the wave patterns (indicated by sticks).



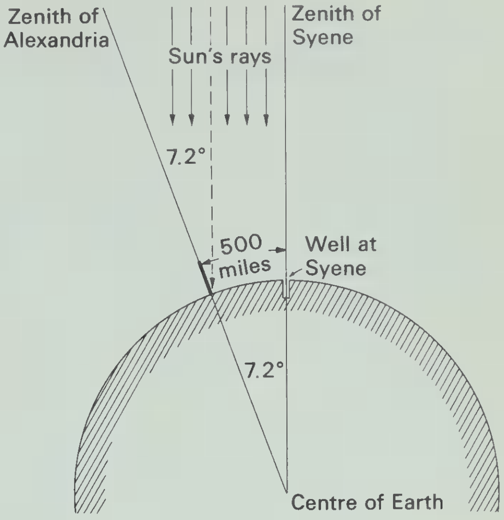


Fig. 1

In South America the ancient Peruvians made relief models of the landscape using stone, clay, and straw. Primitive man used maps to show hunting and fishing grounds, travel routes and territorial boundaries. Many of these maps were very accurate and well orientated, as the North Polar Star and the sun were used to fix positions.

The earliest maps we have that appear to have been based on accurate measurements come from the Middle East. The periodic flooding of rivers such as the Nile, Tigris, and Euphrates led to the destruction of monuments marking the boundaries of properties. In order to restore property correctly to its rightful owner each season, these ancient peoples developed accurate surveying based on mathematical techniques, which in turn led to accurate map-making. The earliest of the Babylonian maps still extant is at least 4,500 years old. It is drawn on a clay tablet and shows a line of hills, a river (probably the Euphrates) and a large estate or land holding. The Egyptians made similar maps (called cadastral plans) and developed very elaborate plans for buildings and temples, which are similar to modern blueprints.

The Greeks and Phoenicians were great travellers. The Greeks established colonies from Spain to the Black Sea, and the Phoenicians circumnavigated Africa. It was in the Greek colony of Miletus that Hecataeus produced the world's first geography book (600 B.C.). Fragments of this book survive and include a map of the world, which is represented as a flat disc surrounded by water. The Mediterranean sea is depicted fairly accurately, as is the Red Sea, but the Indus river is shown in Persia. Africa is called Asia and no detail is shown of northern Europa (Europe).

However, the Greeks continued to travel further afield; Alexander reached India, Hanno travelled along West Africa, and Pytheas sailed round Britain. This voyage of Pytheas is of great importance to map-makers, because he was able to measure the angles of the sun in northern latitudes. These measurements, along with those of other travellers, enabled Eratosthenes to produce an improved map of the world.

Eratosthenes — the Father of geography — also calculated the circumference of the earth in about 200 B.C. Eratosthenes found that at noon on June 21st the sun shone directly down a well at Syene — the sun was thus directly overhead at Syene. At noon on the same day a post at Alexandria gave an angle of 7.2° with the sun's rays. The distance from Syene to Alexandria was known to be 500 miles. Eratosthenes showed that the angle between the sun's rays and the post (7.2°) was equal to the angle between Syene, the centre of the earth and Alexandria.

$7.2° = \frac{1}{50}$ of 360°

Syene to Alexandria = 500 miles

$\therefore$ Circumference = 25,000 miles

The actual circumference of the earth is 24,860 miles, so his calculations were extremely accurate for his time. It is unfortunate that a later Greek scientist, Poseidonius, revised Eratosthenes' calculations, reducing the figure by almost a quarter. It was this latter figure that was accepted by Ptolemy, and affected adversely most of the maps of the Middle Ages. In fact this greatly reduced figure prompted Columbus to attempt a westward route to the east. Had he been aware that the distances involved were much larger than he thought, the epic journey might have been vastly different.

The Eratosthenes map is unique in that it used a grid system for the first time. By using the observations made by Pytheas and others, Eratosthenes drew north-south and east-west lines which gave the positions of a number of places very accurately. His grid lines were not drawn at 1° intervals, however, but only for those places of known latitude and longitude.

It was 100 years later, in the first century B.C., that Hipparchus in Alexandria developed a grid based on degrees. He thus created the meridians of longitude and the parallels of latitude. Ptolemy elaborated on this grid system by creating a prime meridian near the Canaries and constructing a network of parallels and meridians based on it. Modern map-making thus owes much to these early Greek map-makers.

It is interesting to note that by 350 B.C. the Greeks knew the earth was a sphere, yet this information was almost lost, and over 1000 years later map-makers were still portraying the earth as a flat disc.

In the first century A.D. Strabo wrote his "Geographica," in seventeen volumes, which correlated all the work of his predecessors in cartography. Unfortunately the Romans made little use of it. Unlike the Greeks, they were essentially a land power; their early maps were for military purposes and were based on measurements made along the military roads. Distances were usually accurate but shapes were often distorted, and their maps did little to advance the science of cartography. Indeed the late Roman maps, many of which survive today, and those of the Middle Ages revert to the concept of the world as a flat disc.

For the next 1000 years many maps were produced but the methods used added little to the knowledge of cartography. By the thirteenth century the so-called Portolan charts appeared; these marked a significant advance in map-making. The principle adopted in drawing these charts was that of dead reckoning which involved extensive use of the magnetic compass and measurement of distances. The exact location of a large number of places was determined, then lines were drawn out from each of these places conforming to the 16 points of the compass (N, N.N.E., N.E. etc.). Distances were measured along these lines to give the location of other places.

Although these charts were more accurate than previous maps they did have one great disadvantage: magnetic north does not coincide with true north.

The ancient peoples of the Middle East had constructed globes and even simple projections of the globe, but it was not until translations of Ptolemy's book "Geography" reached Europe (about 1400) that serious attempts were made to represent the earth's curved surface on a flat piece of paper. A translation of Ptolemy's work published in Italy in 1477 contained a world map and 26 regional maps, and is thus the first world atlas; it used a simple conical projection. (The book was also significant in using latitude and longitude.) From the time of Hipparchus, cartographers have faced the problem of attempting to represent on a two-dimensional flat piece of paper a three-dimensional object: the curved surface of the earth. Obviously perfect representation is impossible; indeed all maps (except globes) are inaccurate to some extent.

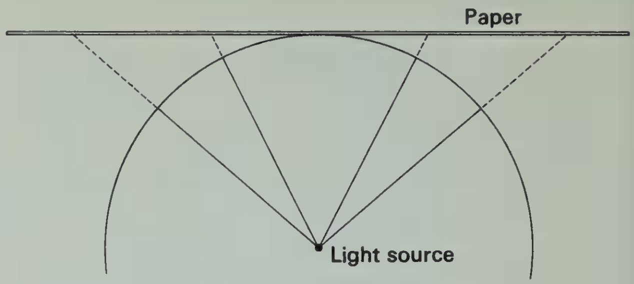


Fig. 2 Example of a projection from centre of earth through the globe onto a piece of paper. Distortion increases away from the place where the paper touches the globe.

Map-makers have constructed many types of projections to represent the curved lines of longitude on paper. Some are based on the idea of a light at the centre of the earth shining through the surface of the earth onto a piece of paper (see *Figure 2*). Others are purely mathematical.

Since this book deals only with topographical maps, projections will not be considered in detail, but it is important to remember that all maps are distorted in some respects.

Two other advances in cartography should be mentioned. In 1527 Fernel finally established that 1° of longitude at the equator was 69 miles and not 60 miles, thus eradicating the error introduced by Ptolemy. Thus Fernel laid the basis for more accurate maps. In the seventeenth century the French established their prime meridian through the Canary Islands; the Dutch through Cape Verde and the British through St. Paul's and later Greenwich. However, between 1767 and 1774 John Harrison at Greenwich in England finally solved the problem of determining longitude by developing very accurate chronometers, and established for all time the Greenwich prime meridian which is used by most major powers.[1]

Since the eighteenth century cartographical developments have been in the field of more accurate survey, better instruments, newer printing techniques, and the development of photogrammetry.

The Topographical Map

Topographic maps, the kind of maps used in this book, show the height and general shape of the land, physical features, such as rivers, lakes, etc., and human settlements and activities in the region.

Detailed, accurate topographic maps really date from the eighteenth century with the development of the *triangulation* method of survey, which is based on the mathematical concept that if one side and two adjacent angles of a triangle are known, then the exact length of the other sides can be calculated.

---

[1] The meridians join the poles; the prime meridian is longitude 0°. The parallels of latitude are drawn parallel to the Equator which is 0°.

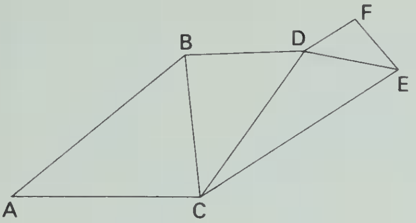


Fig. 3

Triangulation really dates from about 1528 when Munster described a method of geometrical triangulation, but it was the Dutchman Snell (or Snellius) and the Englishman Norwood who, in the early seventeenth century, are credited with outlining scientific triangulations. The first national triangulation survey was completed in France in 1794 after 50 years of work, involving over 2,500 triangles and covering France in 182 maps.

In *Figure 3* points *A, B, C, D, E,* and *F* are prominent landmarks. Since their location is known accurately, they are used as points of triangulation. They are usually identified in the field by a concrete pillar, and on maps by the symbol △ . The instrument used in triangulation is the *theodolite,* which is a telescopic sight mounted on a level table which in turn is mounted on an adjustable tripod. The telescope is mounted so that it can be moved vertically and can also be rotated through 360°. Mounted with the telescope are *verniers* which are scales graduated in degrees so that angles can be measured.

First the distance from *A* to *C* is accurately measured by surveyor's chains, then the theodolite is erected at *A* and the angle *BAC* is found. The theodolite is then erected at *C* and the angle *ACB* is found (at the same time angles *BCD* and *DCE* would be noted).

The surveyor now knows the length of *AC* and angles *BAC* and *BCA*. By using a suitable scale for length *AC*, he can draw a map of triangle *ABC*. He repeats the process to map triangles *BCD, DCE* and *FDE*.

At the same time as he measures the angles, the surveyor uses the theodolite to calculate the height of the triangulation points, and makes notes on changes in slope, elevation of valleys and other important information which is later translated into a map.

This method of surveying a country is slow and laborious but very accurate, since a map is created in which distances, locations, and heights have been carefully determined. However there are many areas, such as the Arctic lands, that cannot be reached by the field surveyor, and map-makers are turning more and more to aerial survey (see pp. 13-22).

Reading a Map

When you examine a topographic map, your work on it will be divided into two phases: firstly, you read the map, identifying information, such as the physical features, from the symbols, colours and lines on the map; secondly, using the information you have now acquired, you make geographical interpretations about the area covered by the map.

Location

Before starting work on a topographic map, use an atlas to check the general location; if latitude and longitude are given on the map, they provide an easy and accurate method for finding the area in the atlas; in other cases, you can determine the location by looking for some distinctive feature on the map, such as a town, a river, a lake, or a mountain peak. Interpretation of the map can be made much easier if you know the general location of the map, as your general geographic knowledge of an area will give you clues to the nature of the region you are studying in detail; however, you must be careful not to use such information to draw inferences that are not readily discernible from the map under examination.

Symbols

Standard symbols on a topographic map are devices, like shorthand symbols, for communicating information quickly without cluttering the map so that it is difficult to read. For example, a mine is always shown by the symbol ⚒ . You should make yourself thoroughly familiar with these standard symbols so that you will be able to read maps easily and quickly. The exercise at the end of this chapter will test your knowledge of map symbols; study the symbols on p. 27 before attempting the exercise.

Scales

Maps can never be the same size as the area they represent. This area must be reduced to manageable proportions, but at the same time the map must be an accurate representation of the area. The degree to which the map is reduced depends on the scale. The scale, then, establishes the relationship between a measured distance on the map and the actual distance on the earth's surface. "Small scale" maps are those in which more than one mile is represented by one inch, and are usually stated as *x* inches to one mile. "Large scale" maps are those in which more than one inch represents one mile, and are usually stated as *x* miles to one inch. On most maps the scale is usually expressed in one of the three following ways.

1. A verbal statement of the scale is a statement such as, "One inch represents one mile."
2. A *line* or *plain scale* is a short line divided into units, each of which represents a distance on the earth's surface. On most Canadian maps the line is usually graduated in inches, each of which represents a given number of miles.
   Note that it is common for the division on the extreme left of the line to be subdivided into smaller units; this is called an *open divided line scale.* Fractions can be read off from this division, which is always to the left of zero.

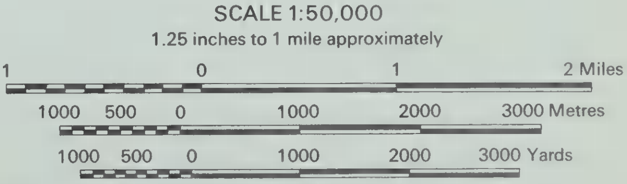


Fig. 4

3. A *representative fraction* indicates the relationship between distance on the map and distance on the earth's surface as a fraction or ratio.
   For example, a representative fraction of $\frac{1}{63,360}$, which is often written 1 : 63360, means that 1 unit on the map represents 63360 units on the earth's surface; or 1 inch represents 63360 inches; or 1 foot represents 63360 feet.

Note that the properites of this ratio are constant:

- *a.* The numerator is always 1.
- *b.* The numerator always represents distance on the map.
- *c.* The denominator always represents distance on the earth's surface.
- *d.* The numerator and denominator always represent the *same units of measurement.*

A verbal scale can be converted to a representative fraction as follows:

1 inch represents 3 miles
∴ 1 inch represents 3 × 63360 inches (1 mile = 63360 inches)
∴ 1 inch represents = 190,080 inches
∴ R.F. is $\frac{1}{190,080}$

Similarly, a representative fraction can be converted to a verbal scale.

Representative Fraction $\frac{1}{31680}$ means that 1 unit on the map represents 31,680 units on the earth's surface; i.e., 1 inch represents 31,680 inches, or 1 inch represents $\frac{1}{2}$ mile. Such a scale is usually given as 2 inches represents 1 mile.

However, in the unlikely event that the scale is omitted from a topographical map, or that you are working from a portion of a larger sheet, lines of latitude provide a rough guide to scale as follows.

One degree of latitude is equivalent to approximately 69 miles.
If the lines of latitude 60° N and 60°10′ N are 2 inches apart on the map,
then 2″ is the equivalent of 10′ latitude ($\frac{1}{6}$th of 1°)
∴ 2″ is the equivalent of $\frac{69}{6}$ miles.
∴ 2″ is the equivalent of 11.5 miles (approx.)
∴ 1″ is the equivalent of 5.75 miles (approx.)
or 1″ represents 6 miles (approx.)

Measurement of Area

If the area to be measured is rectangular, the calculation becomes a simple arithmetical exercise. However, if the region to be measured is irregular, a different method must be used.

Trace the outline of the region onto squared paper as shown in *Figure 5.*

Count the number of complete squares. Then count the number of incomplete squares and consider each as a half-square irrespective of whether it is smaller or larger than a half-square. It is impossible to estimate, say, thirds, quarters, or seven-eighths of a square, but by taking all incomplete squares as half-squares, you can make a reasonable approximation.

If the scale of the map is 1 inch to 1 mile and your squared paper is divided into squares of $\frac{1}{10}$ inch side, each small square represents $\frac{1}{100}$ of a square mile. Thus, in *Figure 5,* the area is calculated as follows:

number of complete squares = 147
number of $\frac{1}{2}$ squares = 52
= 173 whole squares
Each square represents $\frac{1}{100}$ of a square mile,
∴ the area = 1.73 square miles.

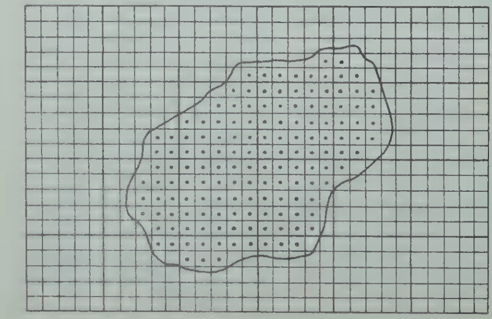
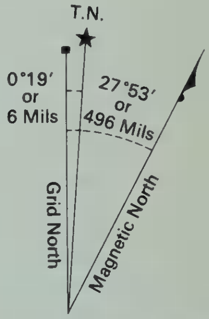


Fig. 5

Direction



Use diagram only to obtain numerical values
APPROXIMATE MEAN DECLINATION 1962
FOR CENTRE OF MAP
Annual change decreasing 4.5′

Fig. 6

Direction on a topographical map is determined by two arrows on the map, one indicating the direction of the *True North* or the *True North Pole* and the other indicating the direction of the *Magnetic North* or the *Magnetic North Pole.* The location of the True North Pole is constant but the location of the Magnetic North Pole varies from year to year. The angle between True North and the Magnetic North is the variation which was recorded on the year the map was published and is known as the *angle of declination.* This date and the annual rate of increase or decrease of the angle of declination is printed beside or underneath the arrows which indicate the direction of the True and Magnetic North Poles. The magnetic declination for any year can be calculated from these data.

A motorist doesn't have to plot a course in order to travel from one point to another; all he has to do is to follow the highways. But pilots of airplanes and ships, operating beyond the range of directional beacons, or travellers crossing trackless terrain have to plot their track on a map to determine their course. This course, based on True North, then has to be translated to a compass bearing, based on the Magnetic North. Since a compass needle points to the Magnetic North, a navigator travelling by land can stay on course once he has calculated his compass bearing. (Staying on course in the air or on the water is complicated by variables such as wind and ocean currents.)

Figure 6 shows the angle of declination as it appears on the 1962 edition of the 1:50,000 topographical map of the Peace River Region (see page 77). The angle between Magnetic North and True North was 27°53′ in 1962, decreasing 4.5′ annually. In 1967, therefore, the angle of declination is 27°30.5′.

If you refer to the Peace River map on page 77 you will see it shows that the town of Peace River is due east (090°) of the Peace River airport. If the pilot of an aircraft wished to fly this route in 1967 he could not do so by setting a course of 090° on his compass, because he would actually be flying a course of 090° + 27° 30.5′ or 117° 30.5′; the further he flew on this route

YEAR	DECLINATION
1965	$27^\circ 36\frac{1}{2}'$
1970	27°14′
1975	$26^\circ 51\frac{1}{2}'$
1980	26°29′
1985	$26^\circ 06\frac{1}{2}'$

the greater his error, and he would eventually end up many hundreds of miles south of the town of Peace River.

In order to make good a course that would bring him over Peace River he would first have to refer to the map to find the course as indicated on the map, due east or 090°. He would then refer to the diagram printed on the map giving the angle of declination and convert this angle to allow for the difference between the present day and the date of the printing of the map. As we have seen this difference in 1967 is 27°30.5′. Because magnetic north, to which his compass points, is 27°30.5′ east of true north to which the map is orientated, he must subtract 27°30.5′ from the course as shown on the map in order to find his compass course.

He would thus use a compass course of 62°29.5′. In actual fact, allowing for wind drift and possible magnetic deviation (distortion of compass reading due to metal in the aircraft) the compass course could differ considerably from 62°29.5′.

To Orientate a Map in the Field

The edge of all Canadian topographical maps is aligned on True North. In order to align the map with a compass, the compass should be placed on an open map spread on a flat surface. Once the compass needle has ceased to move, the map should then be carefully rotated until the arrow labelled Magnetic North on the edge of the map is parallel to the compass needle. Again allowance must be made for magnetic declination. The map is now orientated in respect of Magnetic North and can be used with the compass.

The Grid System

Places and features on a map can be located by relating their position to some point which is clearly labelled on the map, e.g., road junction south-east of village A, or shore line, eastern tip of lake B. However, such references lack the accuracy demanded by surveyors and are sometimes impossible in featureless terrain, such as deserts, or in mountainous regions where few features are labelled.

The most obvious way of establishing the location of places and features accurately on maps of large areas is by reference to latitude and longitude. In theory, the same method is applicable to maps which cover small areas, but, though very accurate, the method is too cumbersome to apply because the degrees of latitude and longitude must be divided and subdivided into minutes and seconds. An alternative method for giving a reference on a map of a small area is a system of grid lines based on the lines of latitude and longitude. The grid used on most Canadian topographic maps is known as the *Universal Transverse Mercator Grid.*

Figure 7 shows how the grid is based on lines of latitude and longitude. On the Mercator Map of the World, lines of longitude and latitude intersect at right angles dividing the map into large rectangles. A number is assigned to every sixth degree of longitude beginning at 180°, which is line 1; 174° W is line 2, 168° W is line 3 and so on to 174° E which is line 60. Line of longitude 72° W is thus line 19.

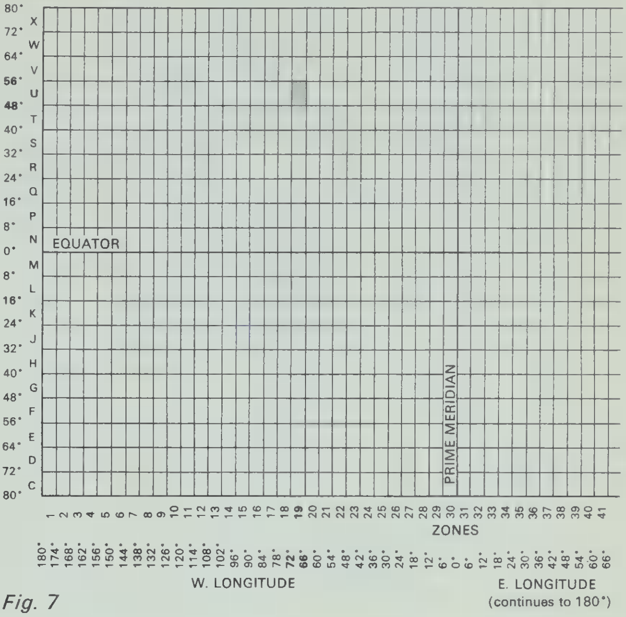


Fig. 7

Lines of latitude are designated by letters to distinguish them from lines of longitude. The lateral grid begins at 80° S and advances from south to north from letter C to X at intervals of 8°. Letters I and O are omitted to avoid confusion with numbers one and zero of the vertical grid. Thus, 80° S is line C; the equator is line N and 72° N parallel of latitude is line X. The parallel of latitude 48° N is thus line U. The Arvida map on page 121, which is in latitude 48°15′ N and 71° W, is part of grid zone 19U, i.e., the zone between 72° to 60° W and 48° to 56° N.

The map of the world is thus divided into large grid zones which cover 6° longitude and 8° latitude. These grid zones present two problems to cartographers. The first problem is one of size. At the equator a degree of latitude and a degree of longitude are approximately equal to 69 miles. Thus these grid zones can cover an area of over 200,000 square miles. Obviously to be of use on maps covering a small area the grid zones must be further subdivided. Another problem arises because lines of longitude are not parallel but meet at the poles, so that the grid zones are not perfect rectangles. This irregular shape is impossible to represent accurately when it is subdivided. In order to overcome these two problems the grid zones are divided into squares of side 100,000 metres. (The metre is one-ten millionth of the meridian distance from equator to pole.)

Figure 8 shows the division of grid zone 19U into its 100,000 metre squares and partial squares. In the original Universal Transverse Mercator grid these 100,000-metre squares were assigned numbers known as the coordinates, but on Canadian and U.S. topographical maps they are identified by letters.

Beginning at 180° and reading east at 100,000-metre intervals the squares are lettered A-Z (less I and O); the lettering is repeated every 18°. Beginning at 80° S and reading north at 100,000-metre intervals the squares are lettered A-V (less I and O); the alphabetical sequence is repeated every 2,000,000 metres on the lines of latitude.

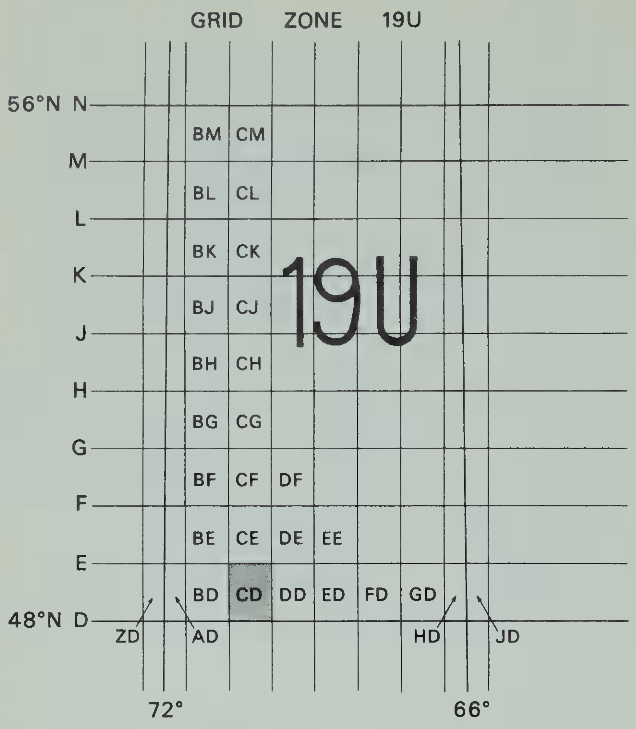


Fig. 8

The location of the Arvida map within grid zone 19U is the 100,000-metre square identified by the coordinates CD.

A square of 100,000 metres is still too large an area to reproduce on a map using a scale of 1:50,000, as it would require a sheet of paper 2 metres or approximately 78 inches square. Therefore, the 100,000-metre square is further divided by a grid of parallel vertical and lateral lines at intervals of 100 metres numbered from the south-west corner of the square.

Fig. 9

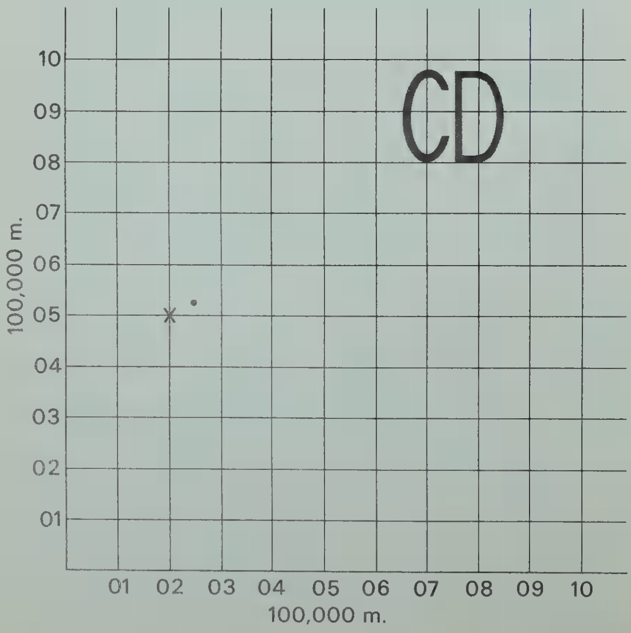
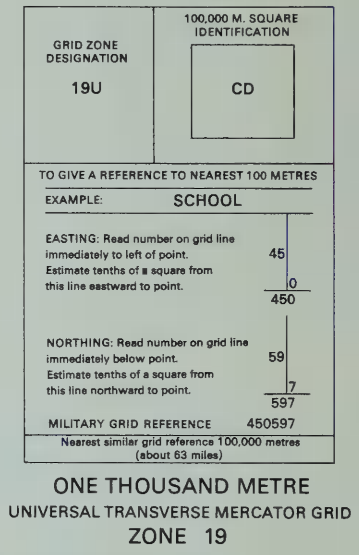


Figure 9 illustrates part of a 100,000-metre square subdivided into 100-metre squares: the grid zone is 19U, the 100,000-metre square is CD. Point *X* will thus have a Full Grid Reference of 19UCD0205.

Suppose, however, a place lies somewhere within the 100-metre square. Its location is given by estimating its distance in tenths east and north of the lines immediately west and south of the place. For example, the point has a Full Grid Reference of 19UCD025052.

Figure 10 is an example of the Universal Transverse Mercator Grid key that appears on all Canadian topographical maps that are based on this grid system. This key gives the Grid Zone reference; the 100,000-metre square identification (the *coordinates)* and shows how to use the grid reference.



GRID ZONE DESIGNATION

19U

100,000 M. SQUARE IDENTIFICATION

CD

TO GIVE A REFERENCE TO NEAREST 100 METRES

EXAMPLE: SCHOOL

EASTING: Read number on grid line immediately to left of point. Estimate tenths of a square from this line eastward to point.

45
0
450

NORTHING: Read number on grid line immediately below point. Estimate tenths of a square from this line northward to point.

59
7
597

MILITARY GRID REFERENCE 450597

Nearest similar grid reference 100,000 metres (about 63 miles)

ONE THOUSAND METRE
UNIVERSAL TRANSVERSE MERCATOR GRID
ZONE 19

Fig. 10

How to use the Universal Transverse Mercator Grid

1. Find and note the number of the grid line immediately west of the point on the map to be identified.
2. Estimate in tenths how far east of that line the point is and make a note of this figure.
3. Find and note the number of the grid line immediately south of the point on the map to be identified.
4. Estimate in tenths how far north of that line the point is and make a note of that figure.

Thus, with reference to the Arvida map on page 121, the grid reference 19UCD3571 identifies the 100-metre square within which Chute Shipshaw lies. In order to identify a point within that square, the Post Office in Chute Shipshaw for instance, estimate in tenths how far east of line 35 and how far north of line 71 the Post Office lies, i.e., it is two-tenths east of line 35 (352) and four-tenths north of line 71 (714). The full grid reference for this point is therefore 19UCD352714 to the nearest 10 metres, though it is unnecessary to include the grid zone or the 100,000-metre square coordinates in map references of maps on a scale of either 1:50,000 or 1:25,000.

Relief

The representation of relief on a topographic map presents considerable difficulty, as the map-maker is attempting to show three dimensions in two. Seven methods are used.

(1) Horizontal Control Points
(2) Spot Heights
(3) Bench Marks
(4) Hachures
(5) Layer Colouring
(6) Hill Shading
(7) Contours

(1) *Horizontal Control Points* (indicated by △) are points the height and position of which has been accurately measured and plotted since they formed part of the original triangulation survey. They are usually marked in the field by a concrete pillar. On maps the height in feet appears beside the symbol.

(2) *Spot Heights* are indicated on maps by a dot and the height, accurately determined, in feet. They are usually located on roads or hill-tops. (They are not marked in the field).

(3) *Bench Marks* are indicated on a map by an arrow and the height in feet, and give the precise height of features, structures, and buildings.

(4) *Hachures* are a method developed in the late eighteenth, nineteenth and early twentieth centuries of showing relief. The very early map-makers drew little hills ∧ ∧ ∧ all over the map, a pictorial method of showing hilly country but which gave little indication of the true heights and locations (which they did not know), and which obliterated everything else on the map. This method of illustrating relief eventually gave way to hachuring, which in turn was to be superseded by contouring. A hachure is a line drawn on a map indicating the direction of slope and the steepness of slope.

Where the slope is gentle (B) the hachures are long and far apart (but always pointing up the slope), and where the slope is steep (A) the hachures are short and close together. The method gives no indication of exact heights, and still has the disadvantage that where the hachures are close together they obliterate everything else on the map.

It is interesting to note that when contour maps were first printed, which was prior to colour printing, hachures came back into vogue for use in conjunction with the contour lines to give a pictorial effect of relief. (*See Figure 12.)*

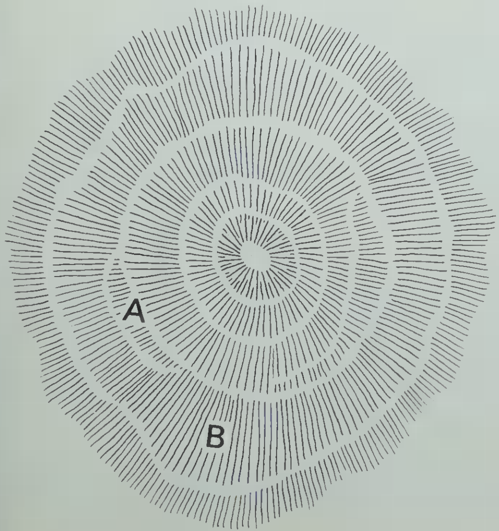


Fig. 11

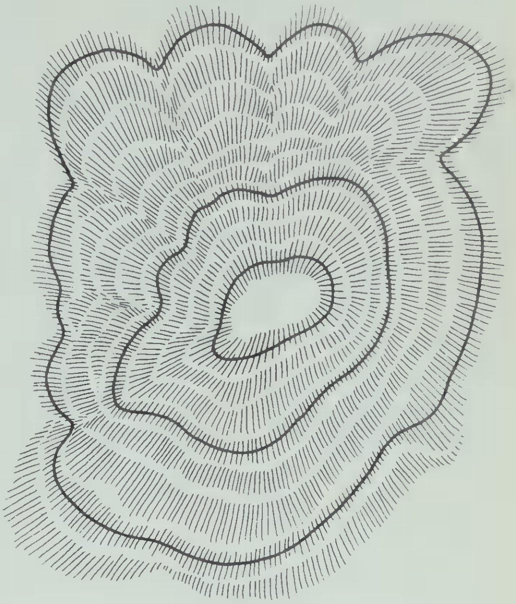


Fig. 12

(5) *Layer Colouring* (or layer tinting) followed the development of colour printing, and exploits colours on maps to illustrate various phenomena such as relief or climate or vegetation. In the Nootka-Nanaimo map on page 67, the land between sea level and 1,000 feet is printed yellow; the land between 1,000 and 2,000 feet is a lighter yellow darkening to various shades of grey for each 1,000 feet up to 7,000 feet; and dark brown between 7,000 and 8,000 feet.

(6) *Hill Shading* is a highly pictorial method of illustrating relief which is particularly effective in mountainous areas. Shadows are drawn on the map as if the sun or a bright light were shining from the northeast corner.

The Mount Revelstoke Map on page 59 illustrates a new technique in map-making because it combines both hill shading and layer colouring. After the hills have been shaded as if a light were shining from the northeast, the areas of heavy forest, light forest, and bare rocks are coloured in green, pale green, and yellow respectively. Because features such as bare rock or heavy forest often correspond to relief, this colouring or tinting makes the physical features stand out clearly.

(7) *Contours* are lines drawn on a map joining places of equal height above mean sea level. This method of illustrating relief developed after areas had been accurately surveyed by the triangulation survey which resulted in a map covered with innumerable dots the height of which was known with great accuracy. Lines could then be drawn joining the places of equal height. However, since contour lines are drawn at intervals of say 10 feet, 25 feet, 50 feet or 100 feet the map-maker often has to estimate where the contour line runs. In this sense, therefore, a contour line may not be completely accurate.

Figure 13 illustrates how contour lines are drawn. The 50-foot contour line will be mid-way between *A* and *B*, will divide *CD* in the proportion of 1:2, and *EF* in the proportion of 1:4.

The difference in elevation between consecutive contour lines is known as the *contour interval.* The contour interval will vary from map to map, depending on the scale of the map and the nature of the landforms characteristic of a particular area.

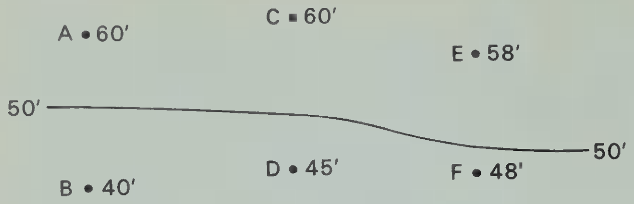
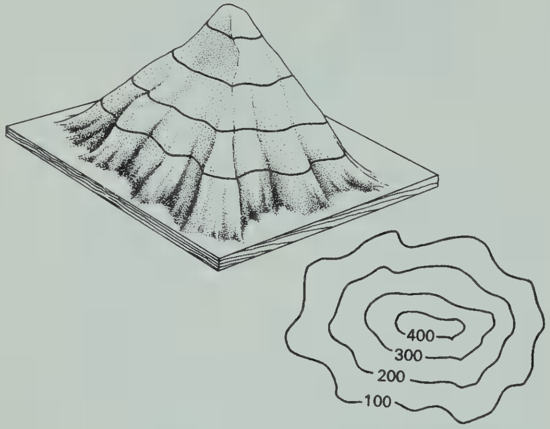


Fig. 13

On a small-scale map where a large area of land is shown in a small space, the map-maker is forced to limit the number of contour lines that can be shown, so that the contour interval is large, e.g., 100 feet or even 500 feet. Conversely, on a large-scale map where there is little variation in the general elevation, the contour interval may be 10 or 25 feet. Compare the Nootka-Nanaimo map on page 67 with the Rosyth map on page 91.

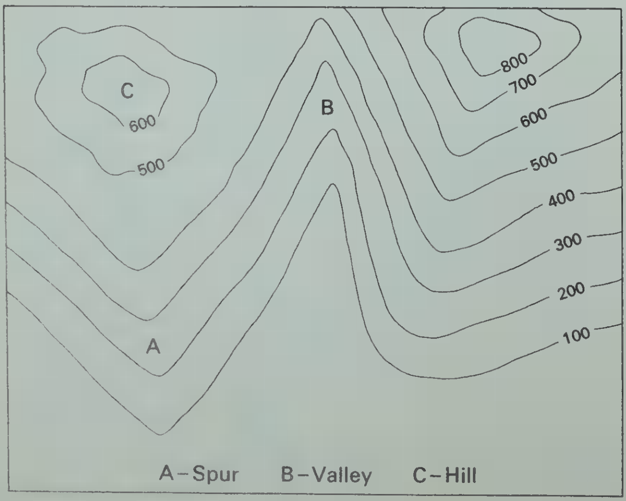
Fig. 14



Contour Expression of Relief Features

The principle of contouring is illustrated in *Figure 14,* which shows a conical hill pictorially and in contour form. If the sea were to rise 100 feet the new coastline would correspond to the 100-foot contour line as indicated on the hill. Similarly a rise of 200 feet would create a new coastline where the 200-foot contour is indicated.

Fig. 15



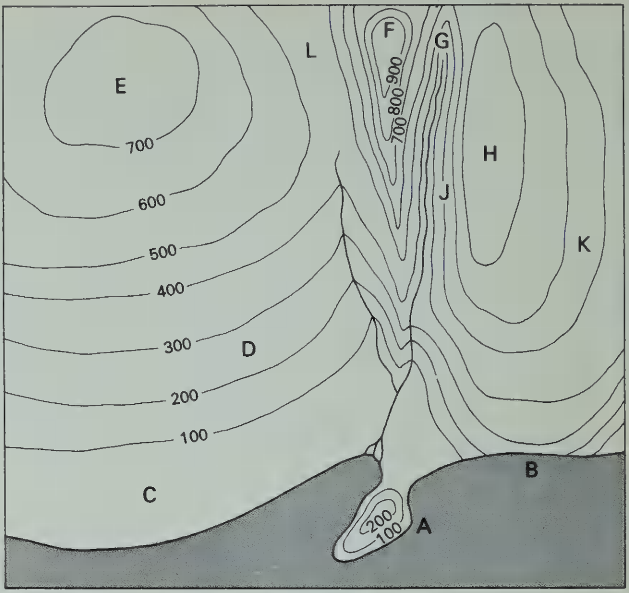


Fig. 16

Figure 15 illustrates in contours three important landforms: a valley, a spur, and a hill. Notice that a valley is represented by V-shaped contours, the apex of which points up the valley towards the hills. The steepness of the valley sides is indicated by the closeness of the contours.

Figure 16 is a contour map of an area illustrating eleven relief features indicated by letters *A-L:* a cliff, an isolated hill, a ridge, an escarpment, a plateau, a scarp slope, a dip slope, a coastal plain, a regular slope, a gorge, and a pass. Determine which feature is indicated by each letter.

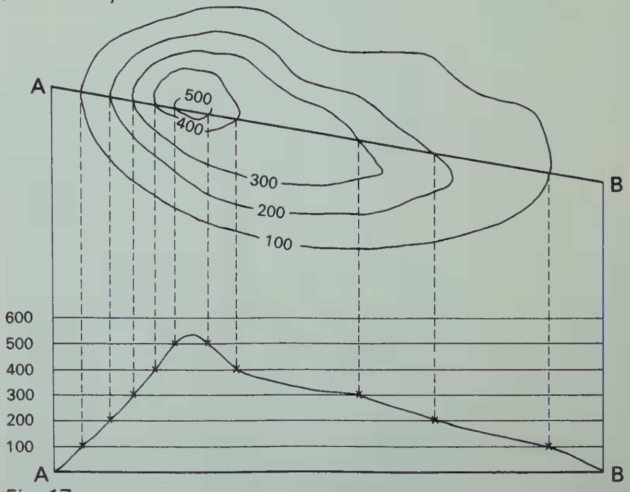


Fig. 17

Profiles

One of the major problems in studying a contour map is the difficulty of visualising landforms from contours. By drawing a profile or a section across the contours, the landform can be represented pictorially as shown in *Figure 17.*

To draw a profile along *AB,* lay the edge of a piece of paper along *AB* and mark on it where each contour line crosses the paper; at the same time record the heights on the paper. Prepare a graph as shown in *Figure 17* using a vertical scale of about

$\frac{1}{10}$th of an inch to 100 feet so that you obtain a natural-looking profile. By laying the strip of paper representing the profile line along the base line of the graph it is possible to transfer the heights to the verticals of the graph. A profile is then drawn by joining the heights represented by points on the verticals.

It is not always necessary to plot every contour, e.g., if a slope is regular only the top and bottom of the slope need be plotted.

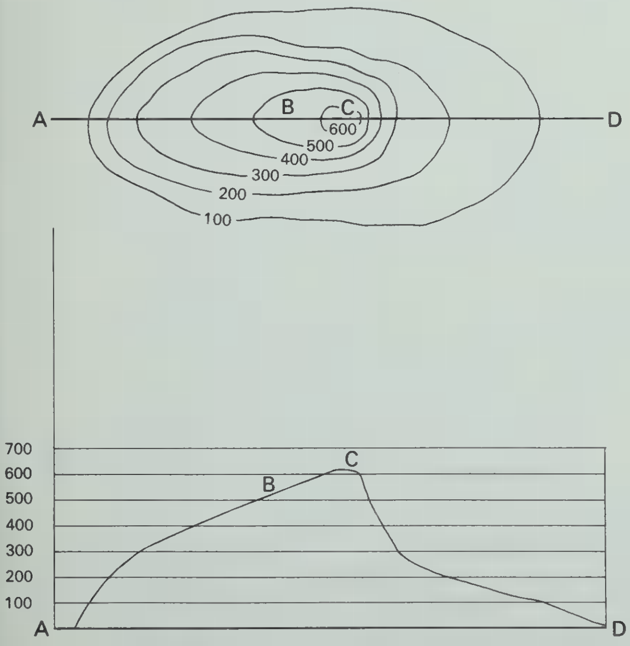
Concave and Convex Slopes

Figure 18 shows the different slope profiles that are caused by changes in the spacing of contours.

From *A* to *B* the contours are close together at the foot of the hill but more widely spaced towards the top, showing a convex slope. From *C* to *D*, however, the contours are close together at the top and more widely spaced near the foot of the slope, showing a concave slope. If the contours are equally spaced, the slope is regular.

Figure 19 illustrates one of the problems in profile drawing. The section line *AB* crosses the 100-foot contour line 7 times. The profile is not a straight line: for example, at *C* the section line comes very close to the 200-foot contour line and this should be shown on the profile. Similarly at *D* it is closer to 200 feet than 100 feet and should be drawn accordingly.

Fig. 18



River Profiles and Gradients

The profile of a river is drawn by taking the river itself as the line of profile. The edge of a piece of paper is laid along the river and moved to conform to the twists and turns of the river. The places where the contours cross the edge of the paper are marked and the profile drawn as previously described.

The gradient of a river can be calculated by finding the difference in height between any two points on the river and also the distance between these two points. The gradient is usually described as being a fall of so many feet per mile.

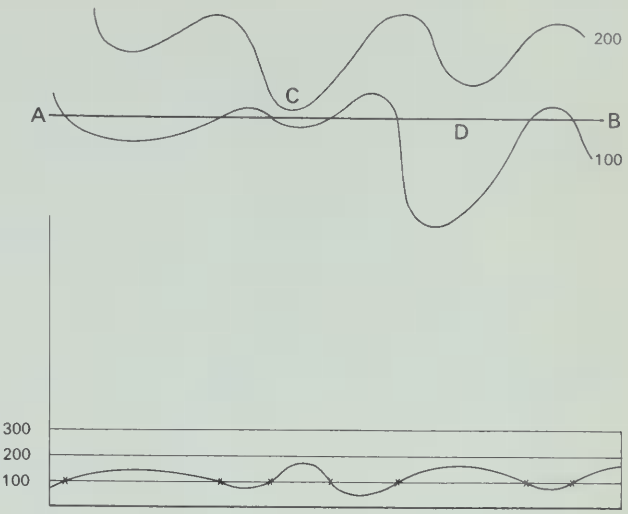


Fig. 19

Vertical Exaggeration

When a section is drawn the horizontal scale is the same as the scale on the map, e.g., 1 inch to 1 mile. If the vertical scale were the same as the horizontal scale, differences in height of several hundred feet would not show on the profile. Indeed the profile would appear almost as a straight line. In practice, therefore, the vertical scale must be exaggerated, usually about five or six times the horizontal scale. In the case of maps of 1 inch to 1 mile, a vertical scale of $\frac{1}{10}$ or $\frac{1}{8}$ inch to 1,000 feet is sufficient to give a profile that does not show too great an exaggeration.

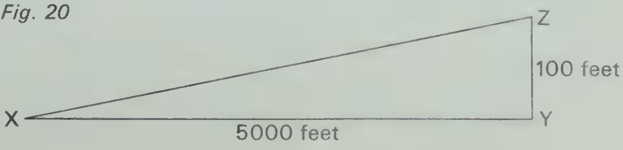
Horizontal Equivalent

A map is a representation on a flat piece of paper of many different types of landforms. If you refer again to *Figure 18,* you will see that the distance *ABCD* is represented on a map by *AD,* but to go from *A* to *D* via *B* and *C* you would walk considerably further than the apparent distance calculated from the map. If the terrain is extremely mountainous there can be considerable distortion of distances. For example, if you refer to the Lake Louise map on page 47 you will see that the distance from the summit of Mount Field to the summit of Mount Ogden is 4 inches or approximately $3\frac{1}{4}$ miles. The true distance on the ground exceeds 5 miles. Care must always be taken to allow for such distortion when using topographical maps for walking tours in mountainous areas.

Gradients

The gradient of any slope is the relationship between its rise or fall in height and its length along the ground. It is expressed as a fraction with 1 as a numerator; if the contours have a vertical interval of 100 feet, and there is a horizontal equivalent of 3,000 feet between the contour lines in a certain direction, then the gradient in that direction is $\frac{100}{3000}$ or one in thirty.

Fig. 20



Two factors determine the gradient of the slope *XZ:* the vertical interval *ZY* and the horizontal equivalent *XY*. The vertical interval can be determined by the contours; in this case the vertical interval *ZY* is 100 feet. The horizontal equivalent *XY* is determined by measuring the distance between the two points *X* and *Z* on the map. The gradient is then calculated as follows.

$$\text{gradient} = \frac{\text{vertical interval}}{\text{horizontal equivalent}} = \frac{\text{V.I.}}{\text{H.E.}}$$

$$= \frac{ZY}{XY}$$

$$= \frac{100}{5{,}000} \text{ or } 1 \text{ in } 50.$$

Gradients of 1 in 7 are unusual on major roads; a gradient of 1 in 2 is too steep for walking, whilst 1 in 60 is unusually steep for railways.

Assignment

1. *Symbols*

Study the map symbols used on topographical maps shown on page 27. Using these symbols draw a map to illustrate the following paragraph.

Two villages A and B are 8 miles apart. They are joined by a double-track railway and a two-lane, hard-surface road. After leaving A the railroad passes through a wooded upland for about 1 mile, which it does by means of a cutting. The remaining seven miles to B lie across a very flat plain which is marshy in several places and drained by a very slow flowing, meandering river. The railway crosses the marshes by embankments and the river by a bridge. The main road takes a winding route to avoid the upland and marshes and crosses the railway by an overpass. Several houses with barns lie alongside the road and a saw mill is located near A. Village A is the larger of the two communities with three schools, three churches, a post office and a telephone exchange. Village B is much smaller with only one school, church and post office. Nearby is an old mine with an abandoned railway spur line and siding. The mine gets its power from Village A by transmission lines. The material for the railway embankment comes from a quarry near village A.

2. *Scales*

(*a*) Draw linear scales 1 inch to 5 miles; $2\frac{1}{2}$ inches to the mile; $\frac{1}{50{,}000}$ to show inches and miles.

(*b*) Express as representative fractions 1 inch to 10 miles; 4 inches to 1 mile; 1 centimetre to 1 kilometre.

(*c*) Express as statements of scale in inches and miles 1:25,000; 1:100,000; 1:31,680.

(*d*) Express as statements of scale in centimetres and kilometres 1:1,000,000; 1:63,360.

(*e*) If 12 inches on the map represent 2,640 yards on the ground, what is the scale of the map in inches to the mile?

3. *Measurement of Area*

(*a*) What is the area represented by (i) the Arvida map on page 121, (ii) the Paris map on page 167?

(*b*) Calculate the area of woodland shown by green on the Medicine Hat map on page 81.

(*c*) What is the area of Toronto shown by pink on the Toronto map on page 147?

4. *Direction*

Using the Peace River map on page 77, give the compass direction from the elevator at Judah of:

(*a*) the elevator at Roma,

(*b*) the Peace River bridge.

Using the same map, find the bearing from the Peace River Seaplane Base of the following:

(*c*) Shaftesbury settlement L25,

(*d*) the Peace River Airfield.

5. *Location*

On the Arvida map give the grid references for

(*a*) the Television tower,

(*b*) the crossroads at St. Vianney,

(*c*) the power transformers in Jonquière,

(*d*) the Arvida hospital.

What features are shown by the following grid references?

(*e*) 443666

(*f*) 397677

(*g*) 429709

(*h*) 363683

6. *Relief*

Study the map of Thetford Mines on page 111. What is the height of:

(*a*) Granite Hill,

(*b*) Murphy Hill,

(*c*) the horizontal control point at grid reference 195128?

7. *Contours*

Trace *Figures 21* and *22* onto a piece of paper and draw in contour lines at intervals of 100 feet.

8. Draw contour maps, each in a square of side 3 inches, to illustrate each of the following:

(*a*) a dissected plateau,

(*b*) a ridge,

(*c*) a gorge,

(*d*) an escarpment 400 feet in height with the scarp slope facing north and crossed by a river flowing south,

(*e*) a 400-foot high pass through a 600-foot range of hills,

(*f*) a glaciated valley with tributary hanging valley and a cirque,

(*g*) a river valley with several tributaries.

9. Draw a contour map to illustrate the following. Use a contour interval of 100 feet and a scale of 10 miles to the inch.
A peninsula 100 miles long by 30 miles wide divides an estuary from a bay. The peninsula drops gradually from a plateau 1000 feet high and ends in cliffs 200 feet high. The bay is bordered by an undulating coastal plain 10 miles wide. The plateau is deeply cut by a river which enters the sea via the estuary.

10. Draw a contour map to illustrate the following. Use a contour interval of 50 feet and a scale of 4 miles to the inch.

Fig. 21 Figures stand for height in feet.

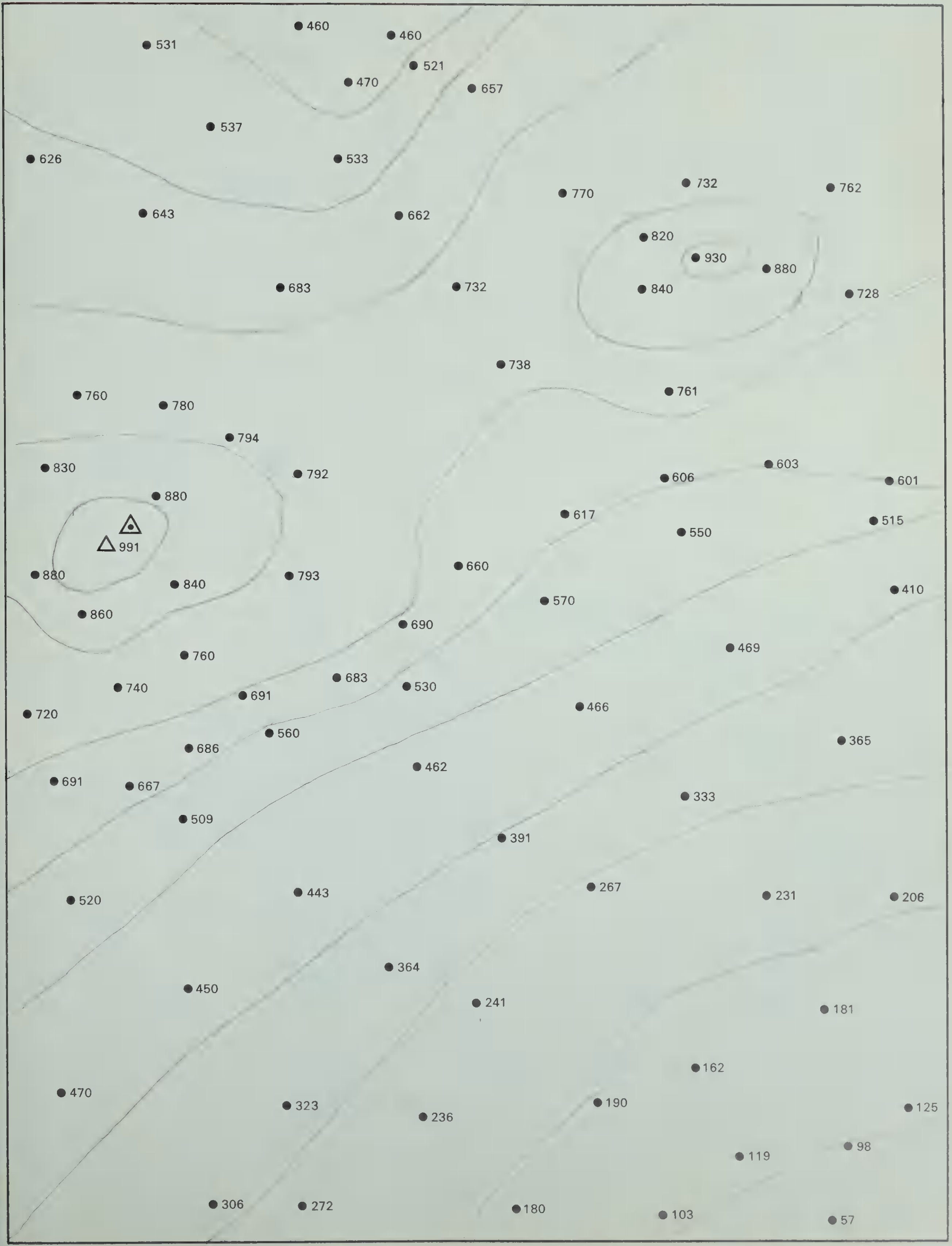
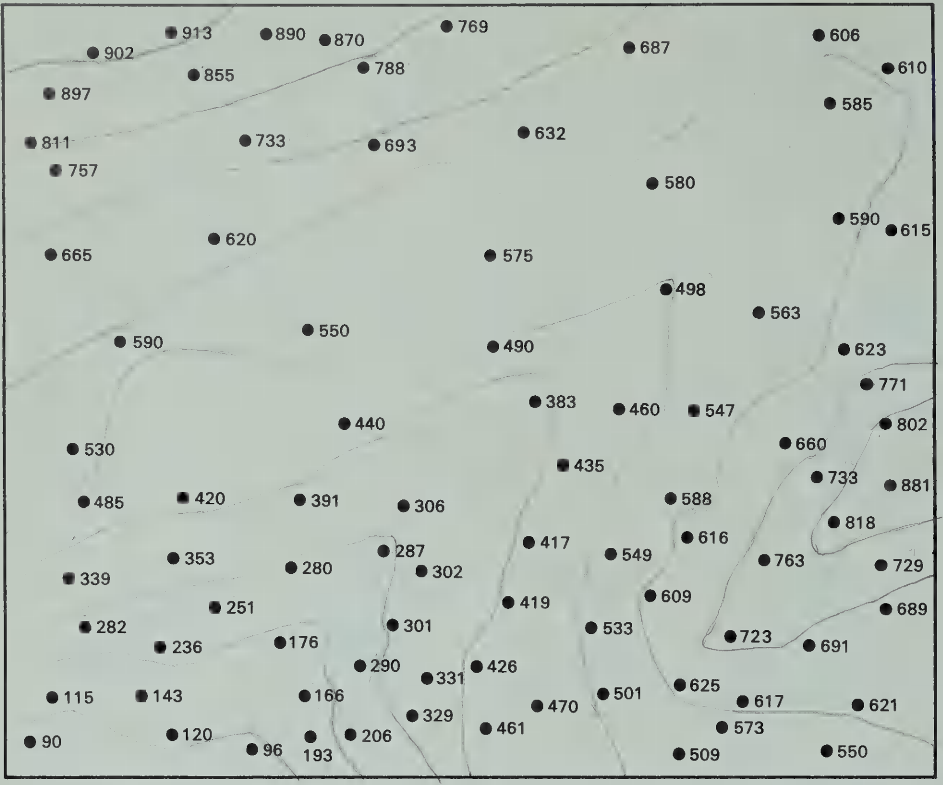

460
460
531
521
470
657
537
626
533
770
732
762
643
662
820
930
880
683
732
840
728
738
760
761
780
794
830
792
603
606
601
880
617
515
550
991
660
880
793
840
410
570
860
690
469
760
740
683
530
691
466
720
560
365
686
462
691
667
333
509
391
267
520
443
231
206
364
450
241
181
162
470
190
323
236
125
98
119
306
272
180
103
57

Fig. 22 Figures stand for height in feet.


913
890
870
769
902
687
606
855
788
610
897
585
811
733
693
632
757
580
620
590
615
665
575
498
563
550
590
490
623
771
383
460
547
440
802
530
660
435
485
420
391
306
588
733
881
818
287
417
549
616
353
280
302
763
729
339
419
609
251
301
533
689
282
723
236
176
691
290
426
331
625
115
143
166
501
617
621
329
470
461
573
120
206
90
96
193
509
550

An area is 20 miles from east to west and 30 miles from north to south. An escarpment 1000 feet high and some 10 miles in width crosses the region from east to west. The scarp slope is to the north and the dip slope to the south, where it is separated from the sea by a coastal plain 2 miles wide. The dip slope is deeply cut into by a river and its tributaries.

11. Draw a contour map to illustrate the following. Select your own scale and contour interval. Give a key to the symbols used. Then draw a section between the two communities. Calculate the maximum gradient of your railway.
An island in latitude 60° south and longitude 80° east is 20 miles from north to south and 12 miles from east to west. On the west the land rises steeply from the sea to a north-south range of hills about 1000 feet in height with peaks of 1060, 1175 and 1236 feet. On the east the land slopes more gently to the sea, and there is a two-mile wide coastal plain above which rises an isolated hill 427 feet high surmounted by a lighthouse. A large river with several tributaries drains from a col in the mountains to enter the sea on the east coast. The south-west coast is very rocky and indented, with several areas of 200-foot high cliffs, but further up the west coast a small stream enters the sea providing a small inlet used as a harbour for fishing boats. This harbour community is linked by road and rail to a large town on the estuary. The hills are well wooded, with a tree line of over 700 feet in the north but only some 550 feet in the south.

12. Draw a contour map to illustrate an area of Alpine glaciation showing U-shaped valley, cirques, hanging valley, matterhorn peak, round-topped hill, arêtes, truncated spur, ribbon lake, braided stream. Select your own scale and contour interval.

13. Study the Thetford Mines map on page 111 and give the grid references for the following relief features.
(a) a regular slope,
(b) a convex slope,
(c) a concave slope,
(d) a round-topped hill,
(e) a peak,
(f) a spur,
(g) a ridge,
(h) a pass,
(j) a col,
(k) a ravine,
(l) a dry valley.
Calculate the gradient along the Ruisseau Madore River from the dam to the Bécancour River.

AIR PHOTOGRAPHS

Individuals have been identified from photographs taken by aircraft flying at high altitudes. The weather forecast on the television screen every night is partially based on photographs from satellites circling many miles above the earth's surface.

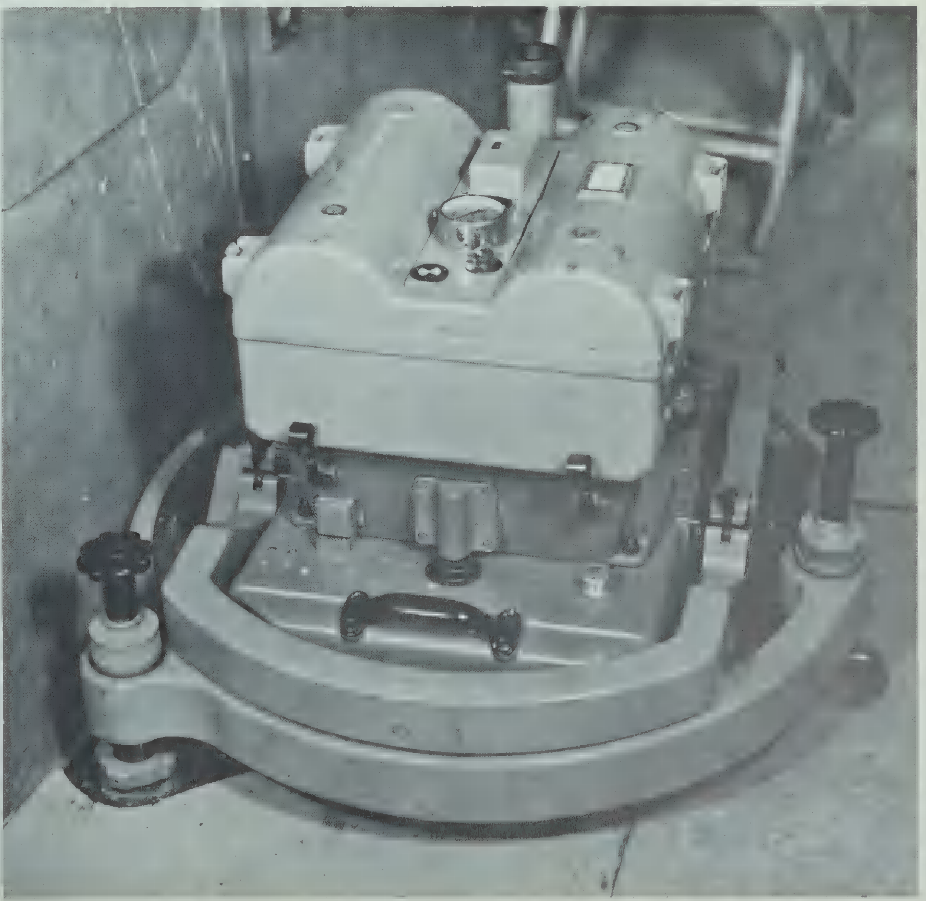
These two examples are part of the modern science of photogrammetry: a science not much more than one hundred and twenty years old, and so new that its potential has not yet been fully explored.

The Development of Photogrammetry

The first important developments in photography took place early in the nineteenth century. The cameras used by early inventors, such as Daguerre, were a simple box; light entered the box through a pin-hole, or through a glass plate which was covered by a dark cloth until the photograph was to be taken. The light entering the box fell on a metal plate which had been light-sensitized with a layer of silver nitrate. After the photograph had been taken, the metal plate was removed from the camera, exposed to mercury fumes, and heated to produce a direct-positive image. (Remember that the word photograph means a picture of light.) In 1841 an Englishman, William Fox-Talbot, developed the negative-positive process that is still in use today.

The first known application of the photograph as a means of producing maps was in 1840, when Dominique Arago, a French geodesist, addressed a group of French deputies (parliamentarians) on the subject of Daguerre's positive image process, showing that official interest was being taken in this new scientific development and its possible uses. In 1858 Aimé Laussedat, known as the father of photogrammetry because he devoted so much of his time to developing the art of photography, used a glass-plate camera to take pictures in the air. In these first attempts the camera was supported by a string of kites.

Kites were later replaced by captive balloons as a method of hoisting the camera up into the air, and a few maps were made from photographs taken in this way. The method proved not to be too successful as the number of photographs taken by any one camera was insufficient to give adequate coverage of the area. However, in default of any other means of raising the camera, balloons continued to be used on a limited scale throughout the



An aerial camera mounted in the floor of an aircraft. Note the large, rigid, all-metal body. A heavy unit such as this lessens the amount of vibration.

latter part of the nineteenth century. In 1862 two French balloonists, La Montaine and Alon, went up in a balloon to an altitude of 1400 feet and took photographs of the defences of Richmond, which was held by the Confederate forces in the American Civil War. From these photographs Captain McClelland, of the opposing Northern army, made maps of the defensive positions of the Confederate forces, which proved crucial in helping to capture the town.

The problem of providing adequate photo coverage from balloons was solved in 1900 when Captain Schempflug of the Austrian army developed a nine-lens camera. This camera consisted of eight oblique-angle lenses grouped around a central vertical lens, so that nine different views could be obtained from one stationary position.

Aerial photographic techniques further improved with the advent of the Zeppelin. Because the Zeppelin was manoeuvrable, and no longer at the mercy of wind and air currents, photographers now had some control over what they could photograph. Zeppelins were invented by a German of that name, and were used in the First World War; a Zeppelin captured in France in 1914 contained aerial photographic equipment.

The piloted aircraft provided the first good navigable platform for the aerial camera, and in 1909 a motion picture was taken during a flight by Wilbur Wright, one of the famous Wright brothers.

You will have noticed that significant developments in photogrammetry were made by military personnel. Military requirements have been the driving force behind much of the development of aerial photographic techniques. In 1913 Captain Tardivo addressed the International Society of Photogrammetry on the use of photographs for mapping purposes. In 1915 the first really practical aerial camera was designed by Lieut.-Colonel J. T. C. B. Moore Brabazon.

The use of the aerial camera for spying out the positions of the opponent's forces led to the development of methods of camouflage. However, little escapes the highly perceptive eye of the camera, and camouflage proved to be a valueless defence, as the tonal pattern of the countryside was altered by the attempts to use it, and these showed up clearly on aerial photographs.

It took some time to convince the British High Command of the value of aerial photographs; in 1915 the R.A.F. were taking only 1,000 prints a day, but by 1918 they were photographing over 10,000 prints daily. At the outbreak of World War II the British were the best prepared in the field of aerial photography, and were able early in the war to detect enemy warships, and later to determine the launching sites of the V-2 rockets. By 1945 aerial photographs had greatly aided the allied landings in Sicily and the invasion of Italy, and had provided information for detailed maps of the defences of Normandy. In the Pacific the United States prepared hydrological charts of previously uncharted waters by using aerial photographs, thus enabling a U.S. Task Force to engage and defeat a Japanese fleet at Kulu Gulf.

The war had been a training ground in aerial photogrammetry and photographic interpretation, and at the return of peace the relatively new science of photogrammetry was firmly entrenched as a research tool with great potential value to many fields of science.

The helicopter provides a good platform for low altitude photography, and has the great advantage of being versatile. Here the helicopter is towing a "bird," which sends out electrical signals to the earth's crust. The returning signal is picked up by an instrument in the helicopter. The "bird" is used to locate mineral bodies.

New Advances in Aerial Photography

The methods used to make maps have changed greatly in recent years. The surface of the earth can now be studied from considerable heights; astronauts have taken photographs from 852 miles above the earth. But it is not necessary to use manned satellites to photograph the earth's surface; orbiting sensors, in which are mounted multispectral cameras, infrared and microwave scanners, imaging radars and other devices, can transmit information easily and quickly from great heights back to the earth.

One of the major advantages of using orbiting sensors is that geographical phenomena that vary from time to time can be photographed at frequent and regular intervals. For example, seasonal changes of crops and vegetation, or urban renewal, can be studied very quickly; major land-use changes can be noted and land-use maps can be updated rapidly. The instantaneous viewing and subsequent mapping of vast areas of land, even of whole countries, is now possible. In addition, places that were inaccessible, or cloud-covered, or behind hostile political boundaries can now be studied.

Geographical research and the mapping of geographical phenomena have a great opportunity to expand with the use of these new methods. These developments are still in their infancy, but geographers of the future will need to know about remote sensor techniques and how to use the information obtained from them. The fields of research opened up by these orbiting sensors are many. Some of them are summarized below.

1. The position, size, shape and distribution of geographic phenomena can be ascertained more easily than in the past.
2. The composition of features or earth materials (minerals) are more easily discovered.
3. The study of radiation temperatures, thermal properties of the earth's materials, even the electrical properties of these materials, is now possible.
4. In land-use studies, the mapping of natural vegetation, of agriculture and urban development is facilitated.
5. In physical geography more extensive studies can be made of geomorphology, hydrology, glacial information, ocean wave and sea ice movements.
6. Knowledge of weather and climate is greatly enhanced by high altitude studies.
7. The detection and interpretation of cultural and transportation geography on a large scale is made much easier.

No longer must man gaze into the sky and speculate, for in the sky will be accurate, scientific orbiting sensors probing the mysteries of the universe and sending back information to help man in his quest for knowledge.

The Science of Photogrammetry

In the twenty or so years since the end of World War II aerial photographs have been found useful in many diverse fields. They are being used successfully for traffic studies, crime detection, metereological observation, space research, geographical research, archaeological survey, and visual education. The Department of Agriculture uses them to determine farm acreage and the distribution of crops; soil conservation authorities study soil erosion by this means; and the Department of Lands and Forests employs them to take forest inventories.

Much of the earth's surface has been mapped from aerial photographs, including parts that have never been mapped before; furthermore, these maps can be continually and easily updated.

The techniques of aerial photography have been perfected to such a degree that some topographic maps, usually referred to as provisional maps, can now be made from photographs. In a country of Canada's size and heterogeneity of physical features the field of topographic mapping has been assisted greatly by the development of aerial photography. Compared with traditional surveying methods, the large expenditure of money required for technical installations for aerial photograph work is balanced by distinct advantages: an aerial survey can be made in a shorter period of time than a ground survey, and areas that are inaccessible or difficult to map from the ground impose no particular problem to the aerial surveyor, if there is an airfield not too distant.

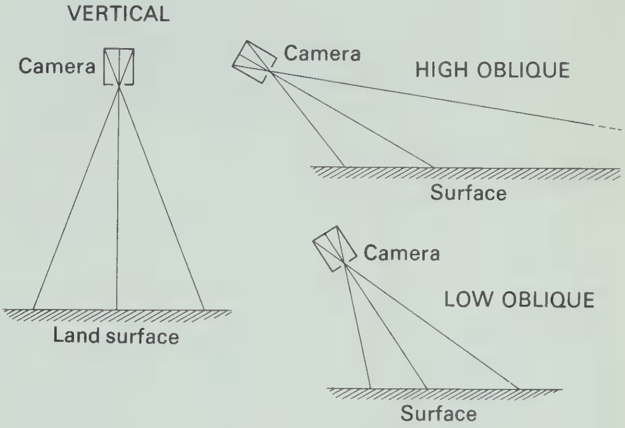


Fig. 1 Camera Positions for Taking Aerial Photographs

The photograph offers many advantages over other forms of surveying. It possesses a wealth of detail and can be reproduced in quantity in a short time, in contrast to the difficulties involved in drawing and reproducing maps. From an aerial photograph the observer has a direct perception of the earth in all its diversities, and he is able to examine the complete terrestial pattern at leisure. One photograph covers only a small area, but the characteristics of a region can be studied by using a *mosaic,* which is an amalgam of a large number of successive vertical photographs (see below), and which gives a three-dimensional view of a large area.

There are, however, certain disadvantages of aerial photographs: distance and direction cannot be exactly measured; relative relief is not apparent unless stereoscopes are used; there is no key or convenient use of map symbols; and the observer is attempting to interpret greys and differentiate between shades of grey.

There are two main types of aerial photographs — *vertical* and *oblique.* Vertical photographs are made using a single-lens camera with the optical axis as nearly vertical as possible at the time of exposure. (See *Figure 1.)* Oblique photographs are produced by tilting the optical axis of the camera from the vertical; as you can see from *Figure 1,* the angle of tilt will determine the type of oblique: high oblique photos show the apparent horizon, while low obliques do not.

Before World War I most aerial photographs were obliques. This type of photograph covers a comparatively large area and is therefore economical. But for mapping purposes oblique photographs have certain disadvantages: the scale varies, because parts of the photographed area are closer to the camera than others; it is hard to find accurate directions; no three-dimensional image is obtained; and because of the angle at which the photograph is taken, considerable distortion occurs. Today, with the great use made of photographs for mapping, vertical photographs are more important. However, high oblique photographs are extensively used in Canada for mapping large areas of low relief, mostly lake and forest terrain in the Canadian North.

The aerial camera is in motion during the time of exposure, and the exposure must therefore be of as short a duration as possible. The camera needs a fast lens, a high-speed, dependable shutter, and a high-speed emulsion for the film. Because aerial photographs must be taken in rapid succession, the camera must contain a magazine to hold large rolls of film or a great number of photographic plates.

The photograph is an instant record of the landscape, and the image obtained will depend on two types of factors, human and natural. The human factors include the focal length of the lens, the flying height of the aircraft, and the film and filters used. The natural factors may vary considerably; they include the position of the sun, the amount of haze, the colour of the objects being photographed, and the time of year the photographs are taken. Before a photographic mission is carried out, all available maps are studied and a flight plan is drawn up. To determine their flight plan the flying crew have to consider weather conditions, flying height, the extent of the area to be covered, and possible drifting of the aircraft from the angle of flight, commonly known as the *angle of crab,* which can be caused by weather conditions. Crab can be eliminated by rotating the camera, but if it goes unnoticed by the flight crew it may cause gapping between flight lines.

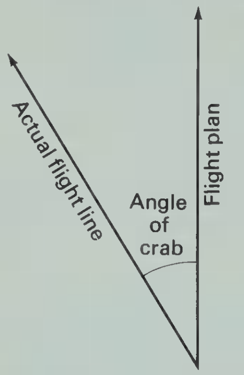
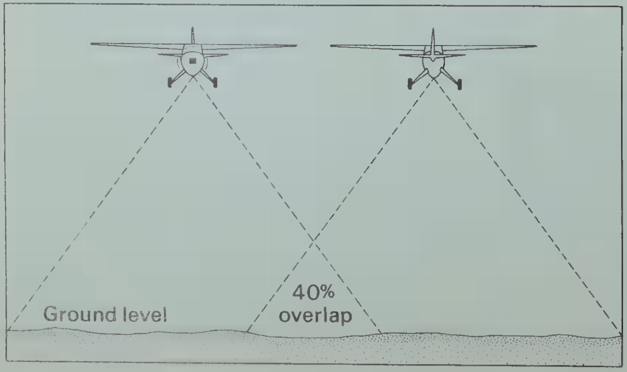


Fig. 2 Crab

The photographs are taken as the aircraft flies over the area to be mapped in a series of parallel strips. An analogy may be drawn between aerial photography for mapping purposes and mowing a lawn; each successive strip of the area to be covered is flown in an opposite direction to the previous strip. (See *Figure 3.*) Flight lines are drawn up so that adjacent strips overlap by about 40% *(lateral overlap).*

Fig. 3 Lateral overlap



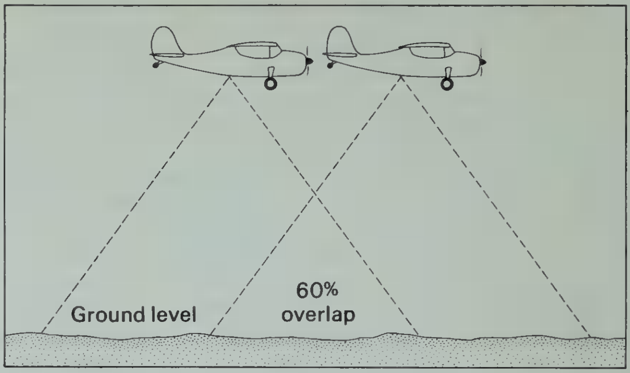
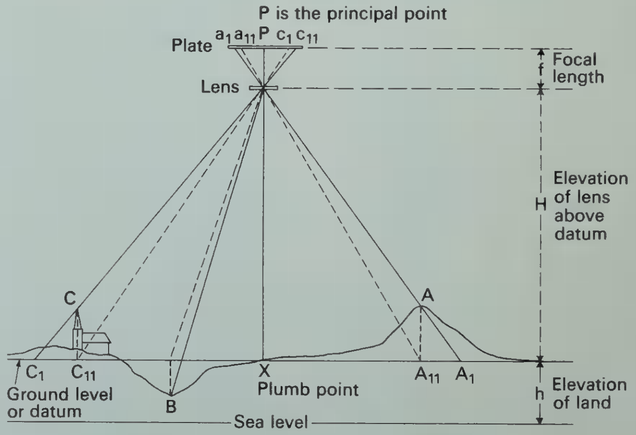


Fig. 4 Forward overlap

Along the flight lines photographs are taken at intervals frequent enough (depending on the speed of the aircraft) to allow successive photographs to overlap each other by about 60% *(forward overlap).*

Overlap is necessary to provide two viewpoints of the same object for stereoscopic viewing. It is also essential for plotting, for in order to tie the different prints together the principal point of each photograph must appear on the edges of as many adjacent photographs as possible. Since the photographs overlap by more than 50% in one direction, alternate photographs overlap by about 20%, and the principal point of any one photograph will appear in different positions on four other photographs, two on each side along the line of flight. Overlap helps to overcome distortion, caused by the tilt of the camera, and displacement, caused by variations in elevation of the landscape, which are greater nearer the edges of photographs. Overlap is also a safeguard against defective prints.

Fig. 5 Displacement



The point on the ground which is vertically beneath the lens at the instant of exposure is called the *ground plumb point.* All other points on the print are registered at an angle which becomes increasingly more oblique the further the points are from the plumb point. In addition, points above or below the general elevation of the ground, or *datum,* will be displaced. This displacement is called *parallax.*

In *Figure 5,* an object above the datum, such as the top of the hill, point A, or the spire of the building, point C, will appear on the datum at points A_1 and C_1 instead of A_{11} and C_{11} respectively and will appear on the print at points a_1 and c_{11} instead of a_{11} and c_1. Thus the building, for example, seems to be tipped away from the vertical, and the distance between c_1 and c_{11} represents the amount of displacement on the print, where the building will be displaced outwards. Similarly a point below the datum (point B on *Figure 5*) will be displaced inwards. Only when the ground is perfectly level will the photograph represent an image correct in scale and direction.

On an air photographic mission the plane is flown at a precomputed altitude to obtain a suitable scale on the photographs, although the altitude, and therefore the scale, may vary due to metereological conditions or an unreliable altimeter. The relationship between the focal length of the lens and the flying height of the aircraft determines the scale of the photograph.

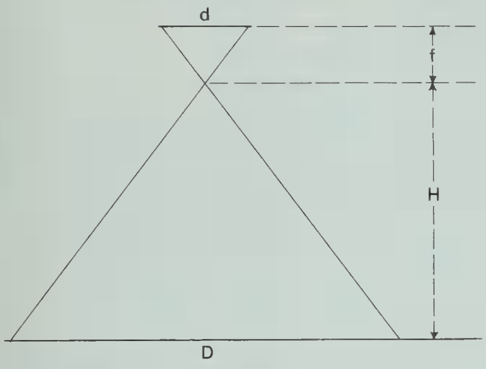


Fig. 6

f = focal length of the camera

H = the elevation of the camera above the datum

$\frac{d}{D} = \frac{f}{H}$ = Scale

In *Figure 6,* using the principle of similar triangles,

$$\frac{d}{D} = \frac{f}{H} = \text{Scale.}$$

A variation of this formula is illustrated in *Figure 7.* Here *h* represents the elevation of the land.

$$\text{Scale} = \frac{\text{Focal length}}{\text{Mean flying height}} = \frac{f}{H\text{-}h}.$$

For example,

Focal length 6″ = .5

Mean flying height 10,000′

$$= \frac{.5}{10{,}000} = \frac{1}{20{,}000}$$

From the formula $S = \frac{f}{H\text{-}h}$ it is evident that when the flying height increases, the scale of the photograph becomes smaller; and when the focal length is greater, the scale is larger. These two factors, flying height and focal length, will determine the number of photographs necessary to cover a particular region. In addition, should the photograph be enlarged or reduced, the focal length is increased or decreased in proportion to the amount of enlargement or reduction, thus affecting the scale. The formula can be applied to determine other variables; for example, if photographs are required at a scale of 1:12,000, the focal length is 6″, and the average ground level above mean sea level is 2000′, the formula can be applied to determine flying altitude as follows.

$$S = \frac{f}{H\text{-}h}$$

$$S = \frac{1}{12{,}000} = \frac{.5}{H-2000}$$

$$\begin{aligned} H-2000 &= .5 \times 12{,}000 \\ &= (.5 \times 12{,}000) + 2000 \\ &= 6000 + 2000 \\ H &= 8{,}000. \end{aligned}$$

The required flying height will be 8,000′.

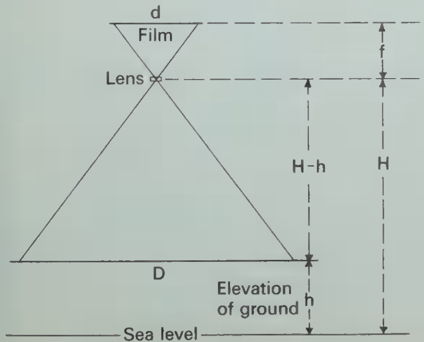


Fig. 7

Stereoscopes

We can perceive depth, or three dimensions, because we see objects with two eyes. Each eye receives a slightly different view of the object. For example, if a small object is held at arm's length, the right eye sees the front and part of the right side of the object, and the left eye sees the front and part of the left side. These two simultaneous images are transmitted to the brain which combines them to produce a three-dimensional impression of the object.

The eyes produce three-dimensional vision by two separate movements: they focus and they converge. When light travels from an object to our eye, it travels as a cone of rays. We automatically change the shape of the pupil of our eye so that the diverging rays are focussed, and we see an image of the object. In effect, the process of focussing the eye traces the rays back to the point where they originated.

The eyes are separated by a distance of between $2\frac{3}{8}$ and $2\frac{3}{4}$ in., which is known as the *interpupillary* distance. Light from an object must travel in different directions to reach each eye; the object and the rays of light reaching each eye form a simple case of triangulation. We can judge distance (or depth) by the angle at which the eyes are converged on the object.

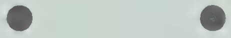


Fig. 8 Stereoscopic fusion

To appreciate these movements of the eyes hold a piece of cardboard, 10-inches wide, on its edge between the two dots in *Figure 8* so that each eye sees one dot. Attempt to look through the page. The two dots will appear to slide together to form one dot. The eyes are focussed for the distance from eye to dot, while the angle of convergence is for a greater distance. You will make use of this effect later when looking at stereo photos.

With the dots fused, slowly rotate the page keeping the head still. The eyes may adjust at first, but will soon register strain, and the dots will blur and split in two. Stereoscopic vision is thus easiest when the line linking the dots is parallel to the line between the pupils of the eyes, known as the *eye base.* This is an important principle to bear in mind when examining stereo

The lens stereoscope enables the user to view two images of the same object, and thus obtain a three-dimensional view. Many lens stereoscopes are small enough to be used in the field.

pairs. The line connecting any two points on a photograph for stereo viewing must be parallel to the eyebase, so that the eyes, the two prints of the object to be viewed, and sight lines along the angle of convergence, or angle of parallax, will all lie in the same plane.

If in *Figure 9* the two pairs of objects are fused the same way as in *Figure 8,* the brain should receive a three-dimensional image. This effect illustrates the one advantage of parallactic displacement.

Photographs are two-dimensional pictures of three-dimensional objects, and the impression of depth is lacking because only one lens (or eye) is used in the camera. In order to have a stereoscopic (three-dimensional) effect, it is necessary to have two pictures of the same scene taken from two points of view. The two photographs are kept about 2.4 inches apart for viewing. The lens-type stereoscope uses two lenses; the left eye sees the left picture only through the left lens, and the right eye sees the right picture only through the right lens. The lenses are supported at focus length above the photographs. The overlapping parts of the two prints can be fused to obtain a three-dimensional image. Shadows cast by objects must be toward the viewer, for if they fall away there is a tendency to see relief in reverse.

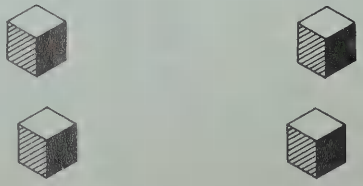


Fig. 9 Perception of Depth in Stereo Viewing

Not everyone can manage the trick of stereoscopic fusion at first; if your eyes are unequal in strength you may have difficulty. However, most people with practice and confidence can see the three-dimensional image. One of the first things that is striking about this image is the appearance of vertical objects. They appear unreal due to an exaggeration of height or depth. This exaggeration is due to differences in parallax between points on the photographs, and to the fact that the viewers' eyebase is about 2.5 inches and the viewing distance above the photographs 5-7 inches (if a lens stereoscope is being used), both of which are small compared with the air base (ground distance between exposure points) and the flying height of the aircraft.

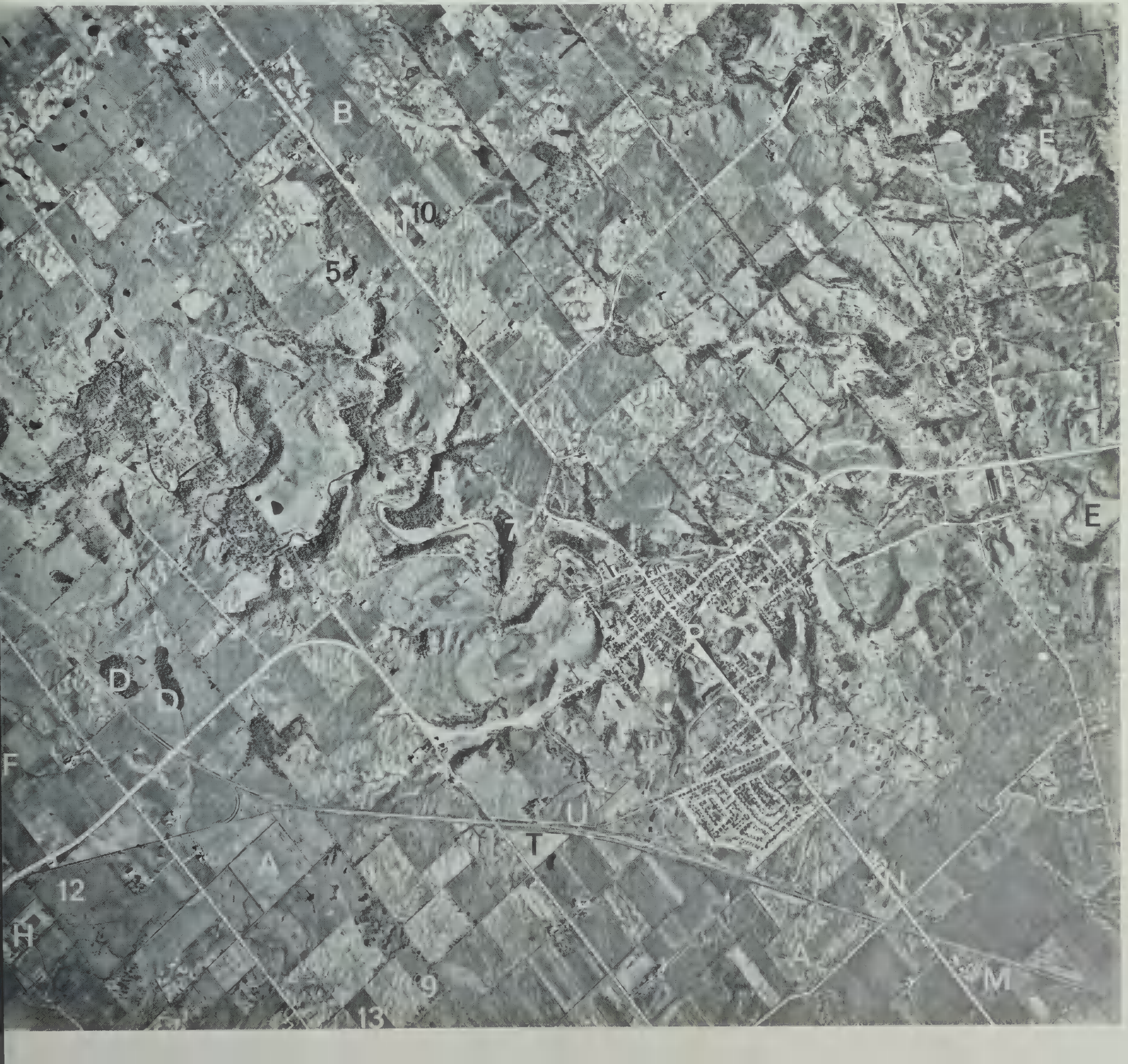
Reading Air Photos

The vertical aerial photograph will appear strange to you at first because you rarely have the opportunity to observe the earth's surface from a vertical position, and because you always see the landscape in its natural colour. The monochrome (or black and white film) employed in aerial photography depicts objects in black and white with many intermediate tones of grey. The student using aerial photographs must understand the factors that govern the tone of a photographic image. This tone is largely dependent upon the amount of light which is reflected from a particular object, and which enters the lens of the camera.

Two vertical photographs have been included here to give you an insight into the reading of photographs. Photograph No. 1 is a rural scene, located north-west of Metropolitan Toronto, around the town of Bolton. The landforms of the area owe their origin to glaciation, and consist largely of an undulating till plain *A.* Notice that there are few shadows in these areas. Small morainic hills are found at *I,* and these are pitted with small lakes *2*. Can you suggest the origin of some of these lakes? Notice that the water has absorbed much of the light and the lakes appear very dark. The depressions in the land are accentuated by shadows. This land is often marshy, or can be determined by the presence of deciduous trees *D*. Large sand deposits are found at *E*, as a result of glaciation. The sand reflects light and is light grey in tone on the photograph. These deposits are easily eroded and extensive gullying is taking place at *3*. The gullies can be distinguished, as the shadows are on the inside. Reforestation is being carried out to help stabilize the slopes of the hills *4*.

Stream dissection has been acute *5*, and the Humber *6* has created quite a wide flood plain. Notice the absence of trees on the land subject to flooding. The meandering river has cut into the till, creating meander scars *7*. These scars are forested largely with deciduous trees *D*. Deciduous trees exhibit both light and dark tones *8*. The crowns of individual trees show light on the side towards the sun and have a semicircular shadow on the side away from the sun *9*. This shadow may be interrupted by other trees, and as a result a deciduous forest has a mottled appearance *D*. These trees usually photograph lighter than coniferous trees because the broad leaves reflect more light than the needles of the conifer. Conifers therefore exhibit a smooth grey to nearly black tone *C*. A mixed forest will have a variation in texture from smooth to billowy.

Agriculture is the major occupation of the area. Cultivated land has a regular pattern and texture *B*, which contrasts strongly with the irregular outlines and course textures of grassland or brushland *G*. The tone of cultivated land ranges from white *10* to black *11*, but the lighter shades are more usual. Cultivated land also has drill or plough marks *12*. Sometimes two definite tones can be seen within the one field. If the outside tone is

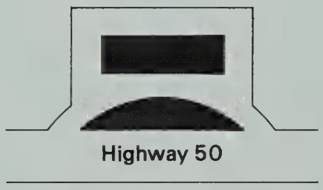


dark and the inside tone is light, the field is being ploughed *F*; if the outside tone is light and the inside tone is dark the field is being harvested *H*.

The identification of crops is extremely difficult, although it can be made easier with use of colour film. However certain clues may be present, *e.g.* corn and potatoes produce a coarser texture than small grains. Grass usually appears as a medium grey in colour, while improved grasses, clover and alfalfa, will appear darker *13*. Orchards are easily distinguished *14*. Notice the round, full crown, the spacing and alignment of the trees, and the nearness to the farmhouse.

Types of farming can often be distinguished by farm buildings, *e.g.* silo, kilns. The farmhouse is revealed by its roof and shadow. It shows greater variation than the barns, and is usually smaller. The houses are often set among trees and the ground around the house is dark because of the grass. The barns are distinctly box-like and most of them have rounded roofs. Many roofs have been painted a light colour; others are made from aluminum, and therefore the roofs of barns tend to reflect light and have a white image. The farmyard will also appear white due to the absence of grass.

Rural non-agricultural activities stand out clearly. Usual activities are mining, forestry and lumber, and transportation. Highway 50 traverses the region from south-east to north-west. Locate the buildings between the highway and the rail line *M*. Notice that there are a larger number of buildings than on neighbouring farms. Then look carefully at the small dots close to the rail line. Their shape and arrangement is characteristic of wood piles in a lumber yard. Follow the highway to the north-east and look carefully at the next building on the east side of the road *N*. It has two driveways in a semicircular pattern. What is this building used for?



Wooded areas are used for recreation and camps. Camps have the characteristic barrack-like plan of the buildings *O* along the creek east of Bolton.

Transportation media are important factors in the reading and interpretation of aerial photographs. The density and type of such media give important clues to the economic significance of a region. Highway 50 is a first-class road. It is wide and straight and cuts through minor obstacles *P*. Compare it with the minor roads to the east. These roads are controlled by minor topographic features and so exhibit numerous curves and bends *R*. Note that when the roads run through a cut *S* the shadows fall across the road. If the roads are located on an embankment or a fill the shadow falls away from the road. The gravel roads are a darker grey than the main highway, and dirt tracks appear very dark grey.

The rail line is narrower than the highway and is therefore a single-track line. There are several freight cars *T* on sidings near the station *U*. Freight cars are usually shorter than passenger cars.

In contrast to the Bolton photograph we next consider part of the city and harbour installations of Montreal (Photograph No. 2). The many cultural forms of the city are more readily identifiable than rural farms, because custom, tradition and function have standardized urban features. Here shape, size and shadow are of utmost importance in distinguishing between features, and often shadow may be the only key to identification. Locate the Notre Dame Cathedral *I*. The shadow of the twin spires is the means of identification on a photograph of this scale. It is also important to consider related features in the urban scene. For example, rail sidings, large parking lots, tall chimneys and low-class residences are characteristic of industrial areas.

Locate the Place Ville Marie *2* and the Stock Exchange Tower *3*. Notice the huge shadows characteristic of the central business district, and also that these two buildings lean away from the centre of the photograph. Why do you think this is so? Delineate the central business district. This area should include the following features:

1. tall buildings,
2. many parking lots (often mistaken for used car lots),
3. buildings extending to sidewalk,
4. alleys at rear of buildings,
5. buildings mostly have flat roofs.

Montreal is one of the oldest cities of North America. Its early growth was due to its position as a route centre and a port. The "old city" is located close to the harbour *A*. It is characterized by narrow, sometimes irregular streets. Using tracing paper outline what you consider to be the borders of the "old city." This area was once the financial centre and several large office buildings are located here *4*.

Montreal has been an important Christian centre from its foundation, and large churches and other religious establishments are characteristic of the downtown area *5, 6, 7*. They can usually be distinguished by their shape, by the presence of spires, and in most cases by extensive grounds. As most of these buildings are old they are not as tall as later buildings.

Hospitals *8, 9, 10* and other public buildings are generally set back from the street, and usually have many wings and courts. They generally have landscaped grounds and parking lots.

Large industry is concentrated in the harbour area. Flour milling is carried on at *11, 12*; the shape of the elevators can faintly be made out. A grain carrier is tied up at the quay *13*. Warehouses have a characteristic box-shape *14*. Oil installations and coal piles are located at *15* and *16* respectively. Most factories occupy a large area, with considerable space provided for parking. Sawtooth roofs are common *17*. Spur tracks and sidings at *18* have many cars on the tracks. In the harbour area blighted areas occur. These have no buildings and the ground is often bare.

Apartment buildings are located *B* in residential areas and along main thoroughfares. Often it is difficult to distinguish high-rise apartment buildings from office buildings in the downtown area, and apartment buildings often have offices and shops on the ground floor in these areas. In residential areas apartments can be distinguished from offices by their location.

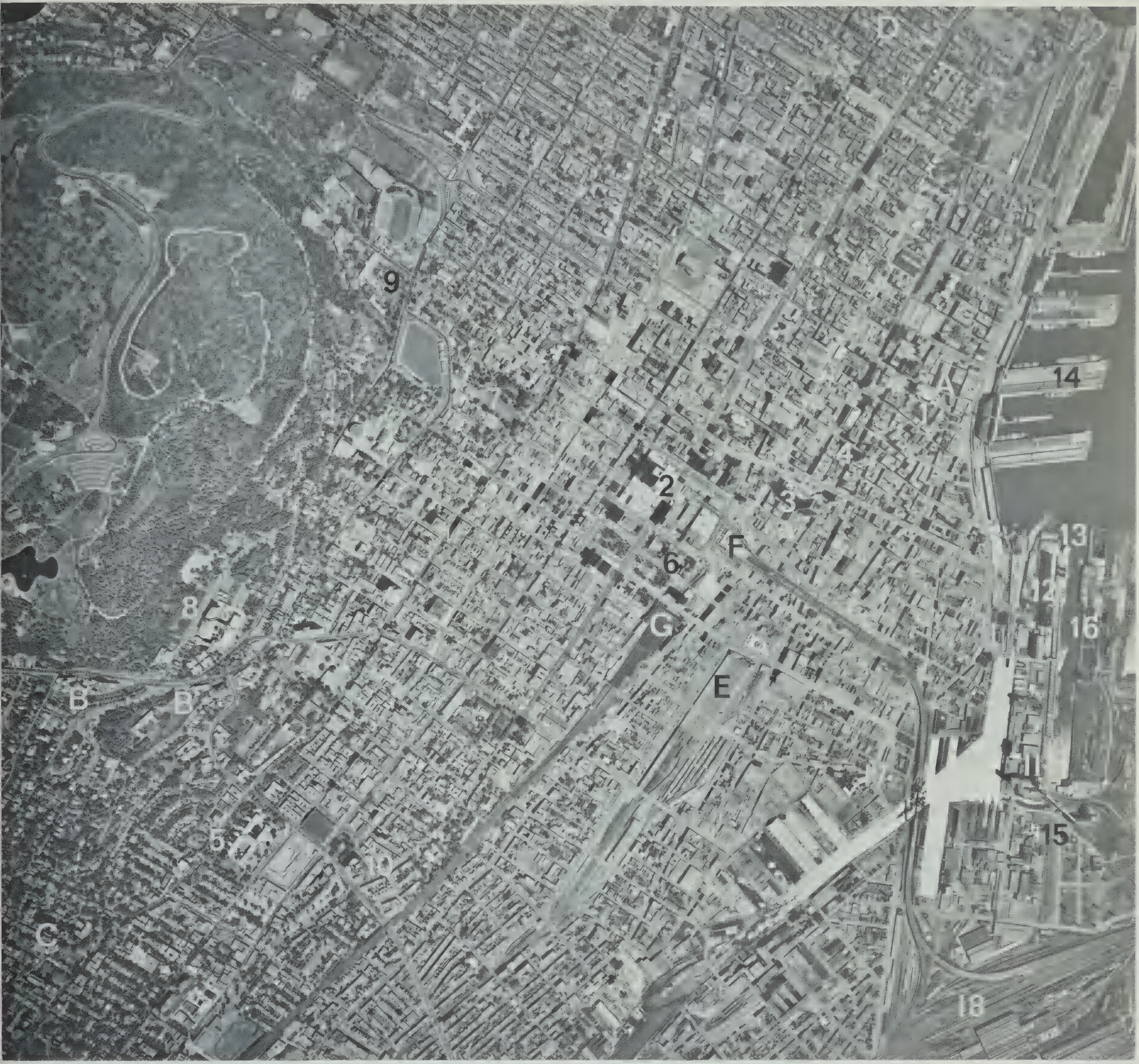
Locate regions *C* and *D* and compare them. Region *C* is the town of Westmount, a high-class residential area, whereas region *D* is the low-class Montreal East district. High-class homes are also located along the edge of Mount Royal.

Montreal's growth has been largely dependent on its location and its transportation media. There are three large stations in the downtown area *E, F, G*. How does station *E* differ from the other two? Do you notice anything strange about station *F*?

The water in part of the Lachine Canal and in the Lachine Basin is white, as the sun's rays are deflected directly into the camera; contrast this with the appearance of the rest of the water in the harbour area.

Many aspects of photo-reading have been covered in our examination of these two photographs, and will serve as a guide when you study the rest of the photographs in the book. When reading aerial photographs, use the following clues.

1. Find the location of the region and try to determine the date and the time of day the photograph was taken. These three



things affect the light over the object and therefore the photographic image obtained. For example, in mid-latitudes a photographic study of soils would take place in spring or late fall when the vegetation cover is less dense; a photographic mission for mapping purposes in the same latitudes is generally carried out when the sun is high in the sky to avoid long shadows which may obscure detail and make mapping difficult.

2. Consider the nature and surface of the object. When light is incident on the surface of an opaque body, part of it will be reflected and the remainder diffused by the surface. The extent of the reflection depends on the surface of the object and the angle at which it receives light. When the camera is in the path of reflected light from a smooth surface, it will receive a quantity of white light irrespective of the colour of the object, and the object will then appear light in tone on the photograph. If, however, the object has a broken surface, a quantity of the light is diffused and consequently less is reflected. The appearance of this object on an air photograph will then be dark in tone. It is possible for the tone of the above images to be reversed if the lens of the camera does not lie in the path of the reflected light from the smooth object but does "pick up" the diffusion of light in all directions from the rough or broken surface.
Certain objects may be smooth enough not to diffuse any light and so to project beams of light. These objects include such things as water, and glass-roofed buildings. When the camera lens lies in the path of this light projection, the object will appear very light in tone, whereas on succeeding or preceding exposures the object may have the tonal reproduction more usually expected of it. (See the Montreal photograph, above.)

3. Keep in mind the shape, texture and pattern of the object. The needles of the conifer reflect a smaller proportion of the light than the larger leaf of the deciduous tree, and the light reflected from the conifer is overshadowed by the very dark shadows thrown by the tree, so that conifers appear very much darker in tone than deciduous trees, especially when grouped together. The natural forest will show no distinctive pattern, whereas a plantation has a definite arrangement.
4. Consider the height of the object, the shadow it throws and the density of like objects. These three factors are very closely linked, as a study of growing crops will indicate. Young crops throw very little shadow and permit light to be reflected from the ground; but as a crop grows it throws more shadow because of its greater height, thereby preventing ground reflection, and the general tone of the area becomes darker. Also, factory chimneys, oil derricks, hydro poles, and tall buildings all have distinctive features. The size of objects is especially important in the study of urban areas due to the large number of different buildings involved. But other factors connected with buildings will help in interpretation. Schools, for example, will have playgrounds and perhaps baseball diamonds or other recreation features. They may also have had wings constructed and perhaps a courtyard in the centre.
5. When considering non-urban areas bear in mind the chlorophyll content of living organisms. The green of a landscape varies in tone in relation to the chlorophyll content of each plant. Photographic emulsion is sensitive to the chlorophyll content as distinct from colour and records this on the photographic image. It is possible, then, to distinguish between improved pasture and rough grazing.

INTERPRETATION OF TOPOGRAPHIC MAPS AND AERIAL PHOTOGRAPHS

You have learned to identify various features from the colours, lines and symbols on a map and their appearance on aerial photographs, and from your reading of map and photographs you have established the distribution of geographic phenomena and their relationships. You can now interpret the significance of these features for the region you are studying. To illustrate this procedure turn to the Vernon map and photographs on pp. 93-98. On the map you will see a thin blue line running *along* the contours. A normal river runs downhill, *i.e., across* the contours. When you read the map you will therefore recognize this as a man-made channel. When you look at the photograph on p. 97 you will see the same ditch running along a mountainside. Uphill from the ditch the mountainside appears to be devoid of vegetation, but downhill some agriculture is apparent. Photograph No. 4 on p. 98 shows that orchards are growing on the land under cultivation. Your reading of map and photographs has enabled you to identify the ditch and the type of vegetation. You can now proceed to interpret that this is an area of irrigated fruit lands.

When you have identified all the features on map and photographs, and established their significance, you will be in a position to write a geographic analysis of the entire region under study. The two facts established above from the Vernon map and photographs will have an important bearing on your discussion of the area and its water problems.

These, then, are the steps you will follow in studying each section of maps and photographs in this book: reading, interpretation, geographic analysis. Always remember that your interpretation will depend on how well you have read the map and photographs.

A few more examples are given here as a guide to what can be learned from a study of the maps and photographs in this book. A map may show by its contours wide open, steep-sided valleys; sharp-peaked mountains; armchair-shaped depressions; long, narrow lakes; and knife-like ridges. Reading a map consists of identifying these features. A careful study of the photographs, whether stereographic, vertical or oblique, will provide you with additional detailed information, on too small a scale to be shown on the map, such as the occurrence of rock outcrops, or the varying types of vegetation. Using this information you can proceed to an interpretation establishing that such an area is characteristic of Alpine glaciation. You can now proceed to a geographical analysis of the area based on man's problems in such an inhospitable region.

Similarly, if a topographical map shows innumerable permanent lakes and rivers and the corresponding photographs indicate forests, you can interpret that the region has an adequate rainfall. However, if you read from the map that the water courses and lakes are intermittent, and the photographs indicate dry valleys or gully erosion, you would interpret this as evidence of an arid climate with periodic heavy rains. Your analysis of a region would be influenced by these factors.

In any approach to the interpretation and analysis of maps and photographs always remember to use only the evidence you can obtain directly from map and photographs.

With experience it should be possible to combine the reading and interpretation stages to build up a geographic analysis. The method suggested below includes points to cover all possible maps; you should disregard those points which do not apply to the specific map you are studying. For example, the analysis takes account of coastlines, although the map under consideration may not include a coastal area.

A Geographic Analysis

Your systematic analysis should conform to the following pattern.

1. Position.
2. Physical features.
3. Climate.
4. Vegetation.
5. Agriculture.
6. Mining, manufacturing and other economic activities.
7. Transport and communications.
8. Settlement patterns.

Position

In this book marginal information on the maps has been omitted and the legend has been included elsewhere. If you are working from a complete topographical map your first step should be to study all the information on the margin of the map. At the same time you should try to locate on the map the areas shown on the photographs. Note the name of the map, as this provides a clue to the location of the map, and also might suggest to you general information, e.g. physiographic region or climate. Should you use such information, however, you must find evidence on the map or photographs to substantiate your statements.

You should try to determine the latitude and longitude of the map because this will tell you not only the precise location, but whether the area is influenced by marine or continental air masses. Again you must remember to confirm any such information by finding evidence on the map or photographs. The names of administrative boundaries, etc., might provide you with cultural or economic information, but be careful not to read too much into the names of places, e.g. the name Canning on the Wolfville map might suggest an area of fruit canning since the town is located in a region of fruit and vegetable cultivation. However, there is no canning factory located in the town.

Whilst studying the marginal information you should also familiarize yourself with the scale, key (legend), and the contour interval.

Physical features

Before studying parts of the map in detail, try to get an overall impression of the relief. Never begin by seizing on one feature only and then attempting to build up a picture of the relief based on that feature. For example, the Orillia map on p. 55 is dominated by the glacial features of the northern part of the map. Unless you study the map generally you might miss the large area of glacial drift to the south, or you might fail to give this area of drift its due importance. Therefore it is essential that you look at the map generally before studying specific areas. Note the elevations (maximum and minimum), and the nature of the terrain (flat, hilly, rolling, mountainous, etc.).

Once you have gained an overall impression of the relief you should study the individual physical features; much of your interpretation will be based on these. You should note the nature of the coastline: is it submergent or emergent? If it is submergent, are there good harbours, e.g. rias or fiords? If it is emergent, note if the coast is marshy or if it has large areas exposed at low tide. Note if there are cliffs, or sand spits, baymouth bars, etc. All this information will affect your interpretation.

Study the drainage pattern, and determine whether it is intermittent or regular. Are the rivers young, mature, or old? Are they deeply indented? If so, can you draw conclusions about the nature of the bedrock? Are there large areas of marsh which might indicate a glacial clay (or an impervious bedrock)? Are there dry valleys? If so, do these indicate glacial spillways or a porous bedrock? Are there innumerable, irregularly shaped lakes, and are they a sign of continental glaciation? Is the drainage pattern dendritic or trellis, and is this pattern an indication of the type of rock? Does the drainage pattern suggest the type of climate?

You should try to determine the geology of the area.

a) A rugged topography is characteristic of a hard rock resistant to erosion.
b) Subdued features suggest an easily eroded, soft rock.
c) A well-marked drainage in a region of abundant rainfall implies a non-porous rock.
d) Porous rock, e.g. a sandy drumlin, resting on a non-porous rock, e.g. a clay, will be shown by little or no drainage on the hills, but the clay between the drumlins may be swampy.
e) The vegetation cover is often indicative of the geology, e.g. even in areas of high rainfall, limestone, being porous, is covered by scrub or poor grass.
f) A thin surface soil overlying non-porous rocks, characteristic of a Shield area, produces swamp vegetation.
g) Human activities on maps and photographs will often provide geological clues, e.g. lime works, lime kilns, or cement works indicate limestone; granite, marble, or asbestos quarries indicate a crystalline rock; clay pits and brick works indicate clays and shales. Agriculture is seldom intensive in areas of limestone or glaciated crystalline rocks, but is characteristic of alluvial deposits.

Before coming to conclusions about the geology you must weigh the evidence of maps and photographs carefully. For instance, not all areas of hard, resistant crystalline rocks show evidence of rugged topography because, if such an area has been subjected to continental glaciation, a fairly uniform surface results, characterised by confused drainage, exposed rock and poor vegetation. Similarly, a soft rock in regions where long droughts are succeeded by heavy rain can be eroded to the point where the relief becomes very rugged—badland topography.

Climate

Latitude will give clues to the temperature, and drainage to the rainfall. Certain physical features are associated with climatic conditions, e.g. bad lands show an arid area with a short season of heavy rainfall. Barchanes, indicated on a map by crescent-shaped hills, are evidence of hot, desert-like conditions, dry valleys might be a sign of limestone or glacial spillways or even climatic change. Playa lakes could indicate a region of intermittent, uncertain rainfall. Swamps are not necessarily an indication of excessive rainfall because they might be a result of a region of impervious bedrock slightly gouged by ice and overlaid by a very thin soil.

Human features such as irrigation ditches, wells and drainage channels are further indications of climate. Vegetation also gives clues to the climate, e.g. a heavily wooded area suggests a very humid climate, as trees require more moisture than grass; but remember the absence of trees is not an indication of the absence of rainfall because the region may be one of porous rock, and trees will not develop under such conditions.

Soils

Since soils are very important in determining the agriculture of an area you should try to ascertain the soil type from information on the map. A tundra soil or lithosoil is almost useless agriculturally because of poor drainage and high acidity. Therefore if your map is in high latitudes, and shows much exposed bedrock and swamp, you can assume that it is a tundra region with a lithosoil and much permafrost. The podzolic soils are very highly leached because of the acid effect of rainwater on pine needles. Such soils are found in regions of coniferous forest in high latitudes. Since vast quantities of lime are necessary to counteract this acidity, such soils are very poor agricultural soils. However, you should note that some plants, the blueberry for example, are tolerant of lime-poor soils and are often cultivated in such areas. The detail necessary to distinguish such plants would only be found on some photographs.

In the regions of broad-leaved deciduous trees (found in warmer, more humid areas south of the coniferous forest), leaching is less intense and more humus accumulates. Consequently the soils are of the brown or grey-brown podzolic types. Such soils are excellent for mixed farming or grains, especially if treated with lime.

The red and yellow lateritic soils of the hot, humid tropics and savannas are poor and excessively leached, a process which removes both minerals and organic plant food. In the interior of continents forests disappear as a result of the hot, dry climate, and the leaching diminishes. The grasslands which replace the forest produce a rich, dark humus. Such soils, known as chernozems, are among the richest in the world, and are excellent for growing grains or for ranching. Where the climate is even drier, however, short grasses predominate and the dense, black colour of the soil gives way to a brown colour (because of the humus). These brown soils are also good for grains; you should look on the map for wind erosion to which such soils are subject. Once again this information is best obtained from a photograph, although in cases of extreme wind erosion indications of dunes and barchanes will be found on the map; many mesas and isolated buttes with very irregular contour lines and little drainage would also indicate wind erosion.

In the transition zone between forest and grassland is found a soil, called a degraded chernozem, where the downward and upward leaching is balanced. This is also an excellent agricultural soil.

You can gauge the fertility of a soil by the denseness of rural settlement and by the various land uses.

Vegetation

You have now seen that the inter-relation between vegetation, climate and soils is helpful to you in determining all three of these phenomena, and that all three are also clues to the economic activities of an area. The new editions of Canadian Topographic maps do not differentiate between forest types (all forests are coloured a uniform shade of green), and also no distinction is made between natural grassland, cleared land, pastoral or arable agriculture (all coloured white). You have seen in Chapter 2 how easy it is to determine vegetation from a photograph, but even in the absence of photographs you can still attempt to deduce vegetation from the map. For example, suppose the map is in latitude 60°N; is largely coloured green; has several large patches of white on which you see small black rectangles; has a very subdued relief; is well watered and shows areas of swamp and small lakes. You might reason that because of the numerous streams, lakes, swamps and subdued relief this is an area of glacial drift. The latitude would suggest coniferous rather than deciduous trees, the patches of white would suggest clearings in the forest, and the little black rectangles would suggest farms with barns. You might be tempted to assume that, because of the latitude and the indication of barns, arable farming is not practised, but remember to check for longitude; it is possible to grow grain even at 60°N in central Canada because of the warm, continental air mass. You should therefore look to see if elevators are present.

Thus, even without a photograph it is possible from a map to make interpretations about vegetation which will help you in your later analysis of the region.

If you have a photograph your task is simplified; do not content yourself, however, with merely identifying the vegetation types. Look for the height of trees, easily seen on an oblique or stereo photograph, but also possible on a vertical by looking for shadows and comparing the shadow of a tree with the shadow of an object whose height you know. The height of trees is another clue to climate and other phenomena; there is a vast difference between the tall, massive conifers of Western British Columbia in latitude 55°N, and the stunted, dwarfish conifers of the Shield in the same latitude, due to differences in rainfall, soils, and topography.

Agriculture

The type of agriculture that develops in any area is dependent on many physical factors such as latitude, altitude, topography, drainage, geology, soils, and climate; economic factors also play a part, such as nearness to large urban centres (dairying), distance from markets (trucking). The accuracy of your deductions about agriculture will depend on how well you have read the map.

Endeavour to identify the type of agriculture. Look at the legend to the map on p. 27 to see if farms are indicated, and if so whether many barns are distinguished, which might indicate pastoral rather than arable farming. If separate farms are indicated you can identify the size and the density of the agricultural population. A Shield region in northern latitudes with large areas of exposed rock and poor podzolic soils will probably give rise to subsistence farming. If you deduce subsistence farming, however, you should look to see if there is any indication of an alternative source of income for the farmer, e.g. winter logging, trapping, minerals, fishing or tourism.

Try to determine if there is commercial farming in the area and whether it is arable (grain, fruit, vegetables, or market gardening), or pastoral (beef, dairying, stock rearing), or mixed farming, or specialized farming (poultry, fur ranches, e.g. fox or mink).

In searching for clues to the agriculture you should take note of such features as irrigation ditches and dams, for irrigation water is expensive and seldom used for extensive cultivation. Grain elevators also are a clear sign of the type of cultivation.

Fishing

You will have determined the nature of the coastline in your study of the physical features. Now you should study the coastal villages to ascertain if fishing is a major occupation. For example, a village huddled at the foot of a massive cliff would hardly be dependent on agriculture. If the hinterland on top of the cliff is poor and unpopulated, this is further evidence that the village is dependent on the sea. Look also for wharves, breakwaters and fish canneries. Consider the approaches from the sea to the village: look for navigable channels marked by buoys and lighthouses.

Always study coastal villages very carefully, because in these modern times few of them depend solely on fishing. If the hinterland is well-wooded, look on the map and photographs for signs of boat building, saw milling, or even pulp and paper. If the hinterland has a well-developed pattern of agriculture look for any evidence of agricultural trade, e.g. canning factories. You should look to see if there is any evidence of a tourist trade, e.g. recreation facilities such as golf courses. In addition you should be aware of the possibility of mineral wealth in the hinterland.

Forestry

Most topographical maps indicate clearly the areas of woodland, but some maps do not differentiate between types of timber, or even between deciduous or coniferous forest. You should not assume, just because the map shows large areas of wood, that it is an area of pulp and paper, because hardwoods are not used for pulp. Try to ascertain the type of tree before drawing any conclusions. Study the forested area and look for logging paths and saw mills. On both map and photographs large numbers of tanks (used for storing the sulphuric acid) in a logging town would be an indication of a pulp industry.

Mining

Most topographical maps indicate quarries, gravel and sand pits quite clearly, but other types of mining are not distinguished, and your deductions about the geology of the area will help you here. For example, if you have determined that the area is one of glacial drift, quarrying would probably be for either sand or pebbles for use in the construction industry. If your study of the geology indicated limestone, the quarry could be for the cement industry or for the smelting of iron ore. Quarrying in a Shield area, however, would probably be for stone for use in construction, road construction for example. You should pay particular attention to the mining methods employed, i.e. is it open-pit, shaft, or adit mining? The mining method is important to your assessment of the economic future of an area because shaft mining is more expensive than open-pit. However, remember that shaft mining is feasible all year round whereas open-pit mining may have to cease (in the far north) in winter. In adit mining the shafts are driven horizontally into the valley sides. This method facilitates extraction of the mineral because deep vertical shafts are eliminated, and it also permits year-round working.

Note if there are crushers, concentrators or separators present at the mining site. Even if the presence of a concentrator is not indicated on the map or photographs, the vast mounds of debris from these machines should be visible. Transportation costs are reduced by crushing and concentrating the ore.

Oil and gas wells do not require the development of sprawling mining communities, but look for the pipelines and try to ascertain their destination. At the same time look for any refineries that may be shown.

When studying the mining of an area always look for the power supply and the transportation facilities, as the nature and extent of these will assist you in your interpretation of the type of mining.

Manufacturing

The industries and manufacturing of an area are an important guide to the local economy. Determine whether the industries are extractive or based on local or imported raw materials. You should note also whether they are primary or secondary, processing or distributive. Study the fuel and power utilised by the industries as a clue to the type of industry (aluminum requires great quantities of electricity), and also the trade and commerce of the area. Look for clues to the local as well as the external trade.

Transportation and Communication

In considering the trade of the area you should also study the transportation communications on the map under the headings of land, water, air.

Examine the density of the road pattern as this will help you in estimating the total population of an area. Unpaved roads are a sign of a scattered rural population; four-lane highways indicate a major route and an urban settlement. A dense network of railways with large sidings and marshalling yards is indicative of industrial development. Other land communications, pipe lines, power lines, telegraph lines, radio and television communications, will all give you an indication of the development and economic importance of the area.

Look at the map to find out if the water transport is by sea, river, lake or canal. Study carefully the dock facilities, particularly their size and number, as these will show the volume of traffic handled by the port.

Today air transport is of ever-increasing importance and you should pay particular attention to airports indicated on the map. Modern jet aircraft require runways several miles long, and cannot operate from grass airports. You should therefore be able to tell if the airport is equipped for jets, and to judge the extent and nature of air traffic.

Population and Settlement

Where man lives is dictated by many factors such as latitude, relief, climate, raw materials, etc. Your studies of these geographical features on the map should now enable you to draw conclusions about the distribution of population.

Study the rural settlement and note whether it is dense, sparse, irregular, nucleated, or scattered. Attempt to explain this distribution by your geographic knowledge of the area. Study the village types, e.g. radial, long lot, etc., and explain how these came into being. Make a rough calculation of the rural population density on the basis of 3 - 5 people per rural household.

Examine the urban centres and try to ascertain their size and functions. Size should be calculated on a basis of 10,000 people per square mile (except in cities with many high-rise apartments, where the population density will be higher). Town functions should be determined: administration, religion, trade, commerce, industry, manufacture, collection and distribution, port, etc. You should try to discover the locational factors of the town, e.g. defence, transport, river crossing, power, raw materials, etc. The growth of the city is important to your interpretation; both Quebec City and Montreal began as defensive river port cities, yet Montreal has outstripped Quebec City in size and functions. You should look for reasons on the map to account for such differences. Try to find any changes that have taken place in the city itself—does anything restrict the expansion of the city, or has urban renewal taken place? Study the inter-relationship between the urban centre and the surrounding countryside to ascertain the degree of inter-dependence: ask yourself where the water supply of the city comes from, or whether surrounding communities are becoming dormitories for the main urban centre.

Give some thought to the special problems of urban centres; search the map to see if you can find evidence of, for example, pollution, or flood control, or transportation problems. No two urban centres have the same problems; London has problems arising out of its size and inadequate road system; Winnipeg has a flood problem; Toronto a problem of growth and expansion; and Montreal a problem of urban renewal. Even smaller urban centres such as Medicine Hat or Arvida have their own special problems—the former has difficulty obtaining new industries because of its distance from markets, and the latter suffers from lack of room for expansion to the north.

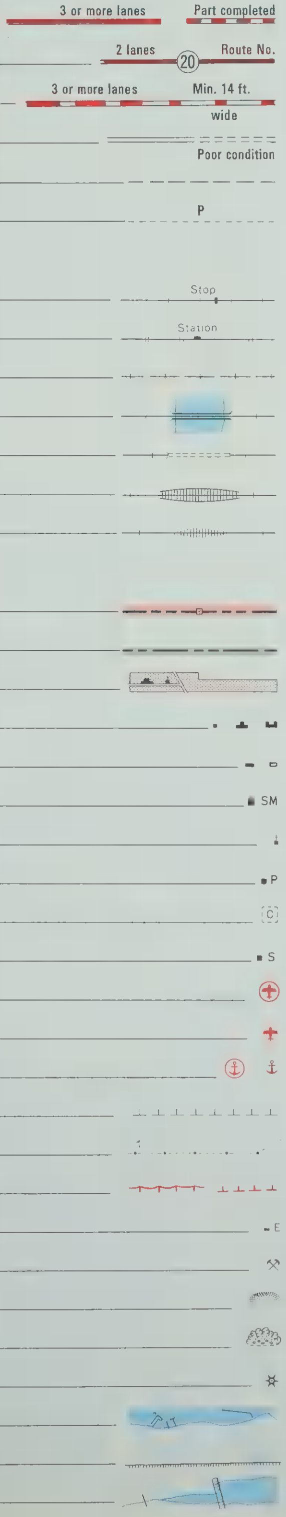
Maps and air photos give many signs of the problems of cities. For example, contour lines might indicate steep slopes preventing expansion; smoke belching from factory chimneys on an air photograph points to air pollution; irrigation ditches are a sign that a town has a water shortage; dams on the upper reaches of rivers flowing through cities might indicate flood control measures.

The questions on the maps and air photographs in this book are designed to help you identify the characteristics of each region. After completing each assignment you should use the facts gained from your map reading and the interpretation you have made to write a complete geographical account of the region. The object of such an account is to show the inter-relationship between the landscape and the development of human settlement, and thus to build up a systematic geography of the region.

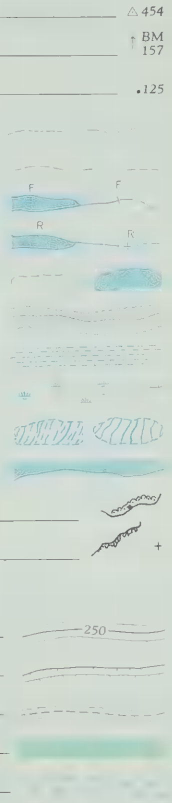
CANADIAN TOPOGRAPHIC MAP SYMBOLS

Maps of Scale 1 : 50,000

Roads:
hard surface, heavy duty
hard surface, heavy duty
loose surface, graded and drained
Other Roads
Cart Track, Snow or Winter Road
Trail or Portage
Railways:
single track
multiple track
abandoned
Bridge
Tunnel
Cutting
Embankment
Boundaries:
international
provincial
Built-up Area
Building
Barn
Mill or Factory, small; Sawmill
Church
Post Office
Cemetery
School
Airport
Airfield or Landing Ground
Seaplane base; Anchorage
Telephone Line
Power Transmission Line
or
Elevator
Mine or Open Cut
Sand or Gravel Pit
Quarry
Lighthouse
Wharf or Pier; Breakwater
Levee or Dyke
Dam, small; large

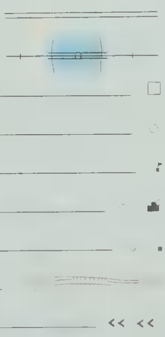


Horizontal Control Point, with elevation
Bench Mark, with elevation
Spot Elevation (in feet)
Stream, intermittent or dry
Stream, indefinite
Falls; large, small
Rapids; large, small
Lake; intermittent, indefinite
Dry River Bed with Channel
Inundated Land
Marsh or Swamp
Glacier or Permanent Snowfield
Foreshore Flats
Bluff, Cliff or Escarpment
Reef; Rock or Small Island
Contours:
elevation
depression
approximate
Forest
Orchard



Maps of Scale 1 : 250,000 (Additional symbols)

Road, loose surface, dry weather
Drawbridge
Town
Village or Settlement
School
Tower; Chimney
Well; Tank
Cliff
Locks



Town Plans

The symbols used on the town plans are the same as those used on other large-scale maps. In addition, the following colour-key is used.

Pink—Public Buildings
Black—Industry, Retail and Warehousing
Light Red—Residential
Grey—Central Business District

WOLFVILLE

The western edge of this map shows the entrance to the famous Annapolis-Cornwallis valley, one of eastern Canada's richest agricultural areas. Three physical regions can be clearly identified from the map. These consist of a basaltic escarpment in the north-west sloping gently to the north; a central region, from the foot of the cuesta to the Cornwallis River, composed of soft rocks overlaid by a great thickness of glacial drift; and the region south of the Cornwallis River which is mostly rolling sandstone hills.

Drainage is from the higher land in the west to the coast-line in the east. The Cornwallis, the main river in the region, is a pseudo-old-age river with many meanders. The coastline forms part of the Bay of Fundy, which experiences exceptionally high tides. The river mouths are estuaries. The rivers have eroded the underlying sedimentary rock, and caused considerable deposition on the shoreline. This deposition, together with erosion by wave action and tidal currents along the coast of the Bay, produces extensive marshes and mud or tidal flats; large expanses of the latter are exposed at low tide. On the map these areas of mud flats are delineated by blue dots.

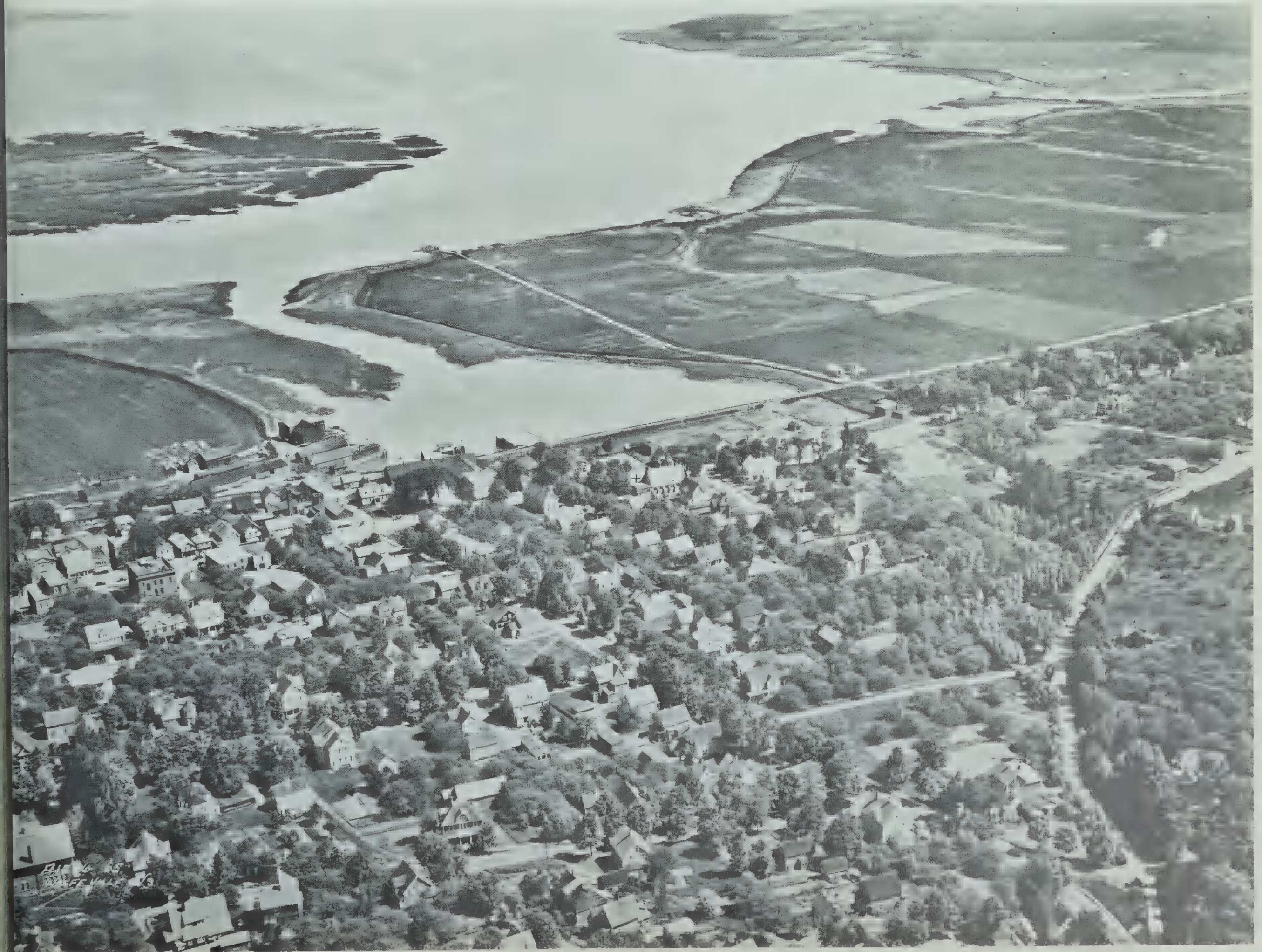
Flooding is so extensive in the area that dykes have been built along the rivers and coastline to protect drained marshland from salt water. Aboideaus, or trapdoors, have been built at several places along the dykes. These trapdoors allow surplus fresh water to be drained off the land at low tide, but prevent inundation by salt water at high tide.

You can obtain some idea of the humid nature of the climate from the numerous streams draining the region. Another indication of the humidity of the area is the abundant forest cover which would not develop under more arid conditions.

Human Geography

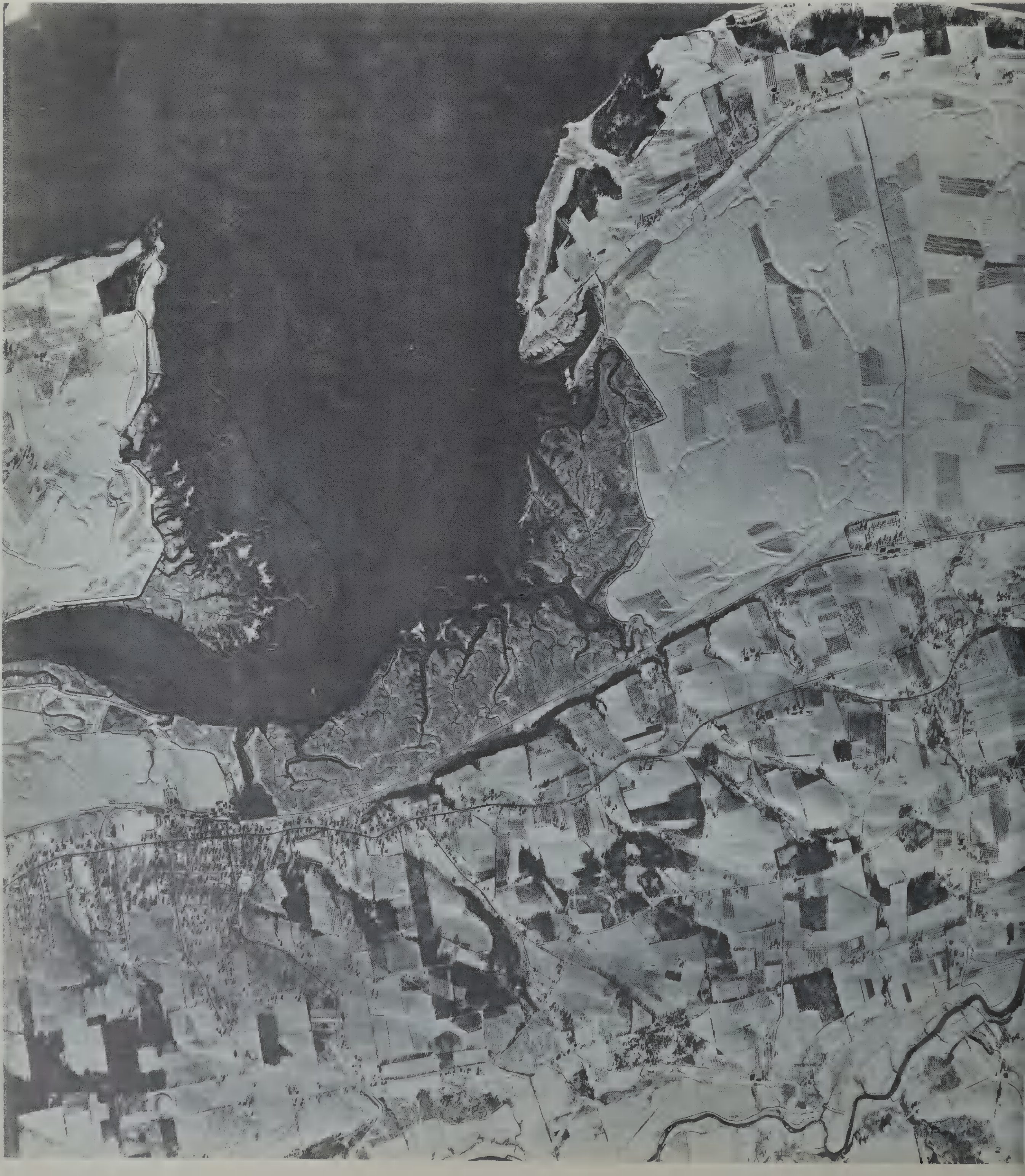
Two major factors determine the pattern of settlement: firstly, settled areas are situated out of reach of the danger of flooding. For example, you can see on the map that settlements in the Cornwallis valley are not found on the alluvial flats, but are

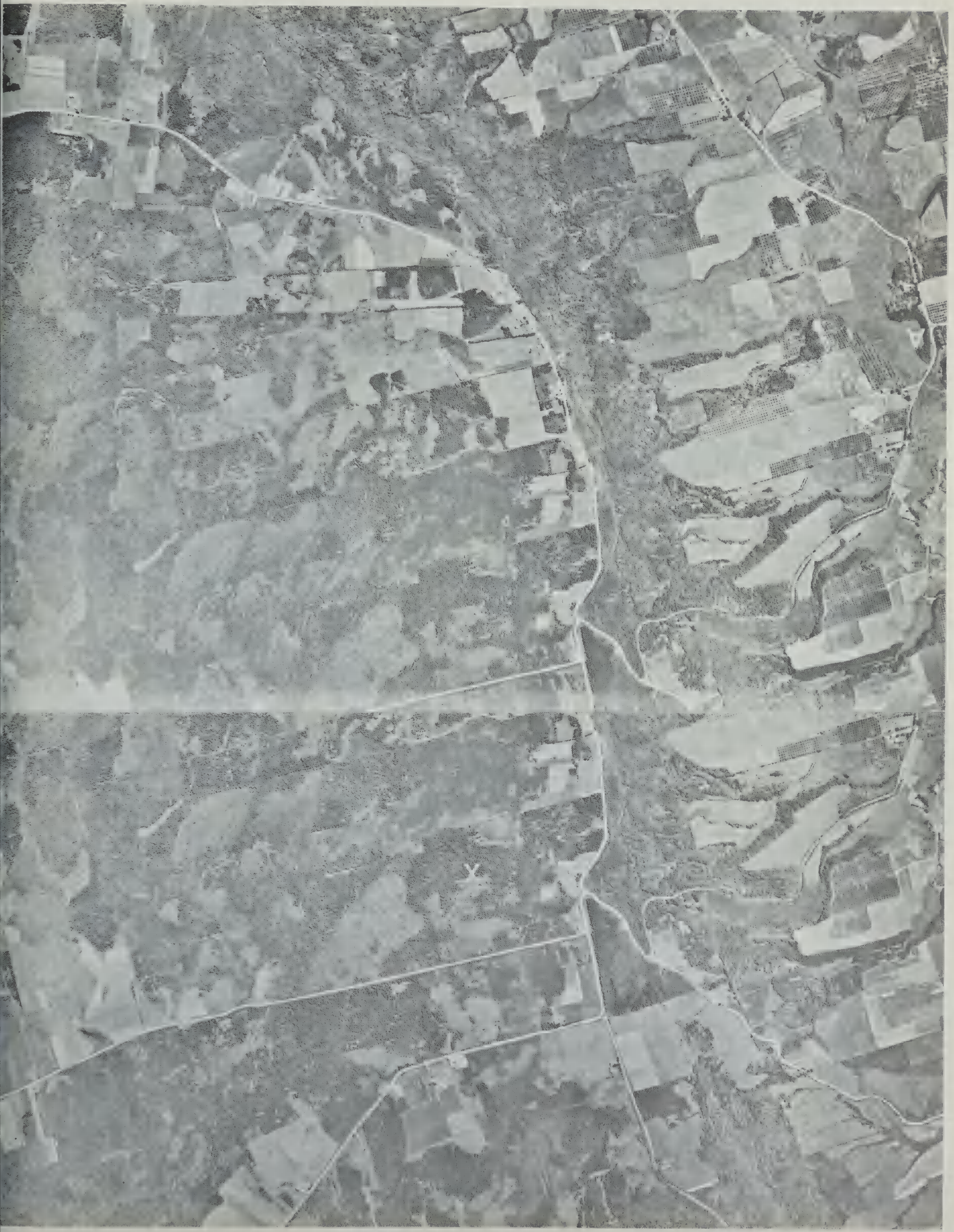
WOLFVILLE 1



sited well back from the river. Secondly, settled areas are close to transportation facilities. Port Williams is at the lowest bridging point on the Cornwallis River; further downstream it would be impracticable to bridge the river because of swamps and tidal flats. At Port Williams the velocity of the river on the left bank is so great that the river scours the area where old wharves were once quite busy. Wolfville, near the mouth of the Cornwallis River on higher ground than Port Williams, was a good example of a tidal port which once handled the larger vessels that Port Williams could not accommodate. But during low tide vessels at

WOLFVILLE 2





Wolfville found themselves some distance from deep water, and so the port facilities gradually fell into disuse.[1]

In the central portion of the map the danger of flooding, and transportation facilities, again determine settlement which is strung out in a line along the highways. Note the absence of settlement in the Canard River valley because of its low elevation and consequent flood danger. In the northern portion of the map the cuesta is a third factor in the settlement pattern, as is shown by the concentration of people along its foot.

The major land use in this area is agricultural, with no evidence of mineral wealth other than gravel pits. The main form of agricultural activity is indicated by such a name as the New Minas Fruit Co. Spur, and processing of fruit will be a major industrial activity. Other economic activities will involve fishing in the Bay of Fundy and duck shooting in the swamps of the Canard River.

---

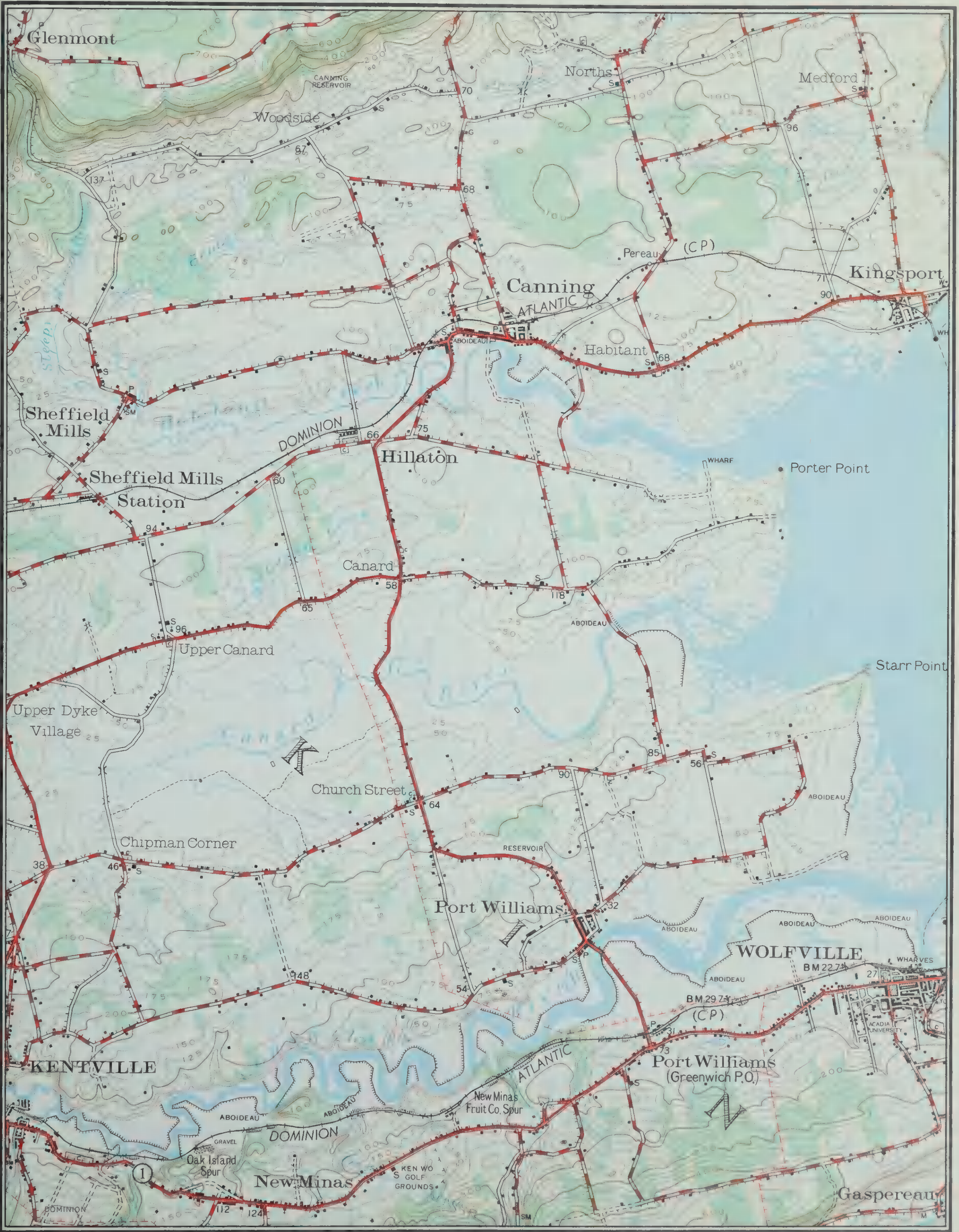
[1] As larger ships became more common and other transportation facilities (railways and highways) more efficient the wharves at Wolfville and Port Williams were abandoned and dismantled.

Assignment

1. What is the scale of this map in inches and miles?
2. What is the length and breadth in miles of the area covered by this map?
3. (*a*) What is the distance from the wharves at Wolfville to the navigable channel at low tide? Find the wharves and the navigable channel on Photograph 1.
    (*b*) Compare Photographs 1 and 2. Which one was taken at high tide and which at low tide? How do you know?
4. What is the interval between contours generally and between thickened contours?
5. Using a vertical scale of either $\frac{1}{8}''$ or $\frac{1}{10}''$ to 100′, draw a section or profile from Glenmont to Hillaton. Name all physical features along the section.
6. What type of river is the Cornwallis? In what ways is it an example of this type of river?
7. (*a*) What evidence is there on this map of flood danger and of man's effort to combat it?
    (*b*) Locate Starr Point on Photograph 2. Identify from the map the feature running south from Starr Point. Locate a similar feature on Photograph 2. What functions are served by these features?
8. Choosing one example of either a railway line or a highway, show how that means of transportation has had to accommodate itself to the physical features of the area.
9. (*a*) What geographical factors determined the sites of Wolfville and Port Williams? In the case of Wolfville study Photographs 1 and 2. Suggest reasons for the eventual abandonment of Wolfville as a port.
    (*b*) In what way was the relationship of Kingsport to Canning similar to the relationship of Wolfville to Port Williams?
10. Would there be any possibility of hydro developments on any river shown on the map? Justify your answer.
11. Refer to the east side of the inlet leading from the Cornwallis River to Wolfville and find a discrepancy between the map and Photograph 1. Which is more recent, the photograph or the map?
12. The "T" shaped road junction indicated by A on the south of the stereo photograph is the one that may be observed at the village of Norths on the north side of the map.
    (*a*) Using stereo glasses identify the dominant physical feature on the stereo photograph. Which slope faces south?
    (*b*) Find on the stereo the road leading north and west from Norths. From a study of the stereo photograph identify the physical feature on both sides of the road.
    (*c*) What type of natural vegetation dominates the major landform shown on the stereo?
    (*d*) From a study of the stereo photograph identify the main agricultural land uses south of the major landform. Which of these land uses is found to a lesser degree north of the major landform?
    (*e*) With reference to both the stereo and the map, try to determine why roads would be built north of the major landform rather than south.

WOLFVILLE

Scale 1: 50,000


Glenmont
CANNING RESERVOIR
Norths
Medford
Woodside
Pereau
(CP)
Kingsport
Canning
ATLANTIC
ABOIDEAU
Habitant
Steep
Sheffield Mills
DOMINION
Hillaton
WHARF
Porter Point
Sheffield Mills Station
Canard
ABOIDEAU
Upper Canard
Starr Point
Upper Dyke Village
Canard
K
Church Street
ABOIDEAU
Chipman Corner
RESERVOIR
Port Williams
ABOIDEAU
ABOIDEAU
ABOIDEAU
WOLFVILLE
WHARVES
BM 22.7
ABOIDEAU
BM 29.7
(CP)
ACADIA UNIVERSITY
KENTVILLE
ATLANTIC
Port Williams (Greenwich P.O.)
New Minas Fruit Co. Spur
N
ABOIDEAU
ABOIDEAU
GRAVEL
DOMINION
Oak Island Spur
1
New Minas
KEN WO GOLF GROUNDS
Gaspereau
DOMINION
SM

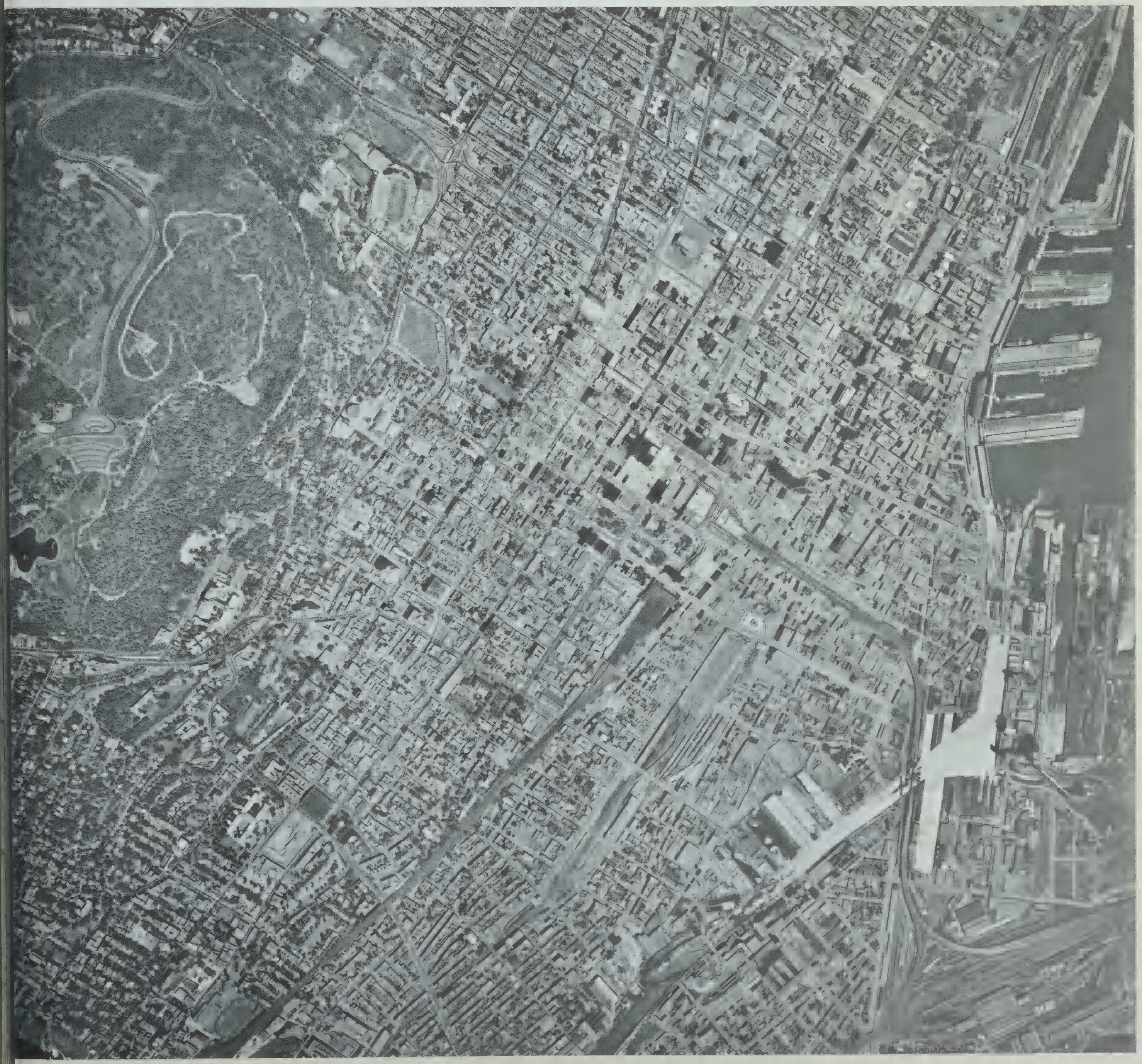
MONTREAL

The area shown on this map is downstream from the confluence of the Ottawa and St. Lawrence rivers. The effect of riverine deposition is clearly illustrated in the St. Lawrence River to the east of Ile de Montréal. Deltaic deposits occur at the mouth of the Chateauguay River. Islands formed by riverine deposition are common in this area. The Ile Ste. Thérèse is a good example; it has been formed as a result of two circumstances: the erosive action of the St. Lawrence River, and marine clays lying over almost horizontal limestone and shale layers. The river has cut through the marine clays to the limestone and shale which are more resistant to erosion than the clays. The clays were washed downstream until the flow of the river slackened in the vicinity of Ile Ste. Thérèse, and the clays were deposited there.

Upriver from Ile Ste. Thérèse the river has exposed rock outcrops, known as the Lachine Rapids, which have resisted rapid erosion in spite of the accelerated flow of the river, and have, in combination with a narrow river channel, effectively blocked the river to create Lac St. Louis. The Lachine Canal was built as a detour for shipping around the rapids.

To the extreme north-west of the area on the map is the Canadian Shield, and to the southeast are the Appalachian Mountains. Between these two physical features, and covering

MONTREAL 1



most of the area shown on the map, is the Montreal Plain, which is composed of marine clays deposited during the time of the Champlain Sea. Coincident with the deposits of these clays, a mantle of glacial drift was left over most of the area shown. The clays, combined with rather flat topography, have produced swamp and intermittent swamp conditions to the north of Ile Jésus and minor swamps on Ile Jésus itself. South of the river, these conditions do not exist to the same degree because many swamps have been eliminated by drainage of the farmland.

The main island, Ile de Montréal, is composed mostly of marine clays; bluffs and terraces have been created in the past by river erosion and by the rising of the land. The relative flatness of the island is broken only by Mont Royal, one of the Monteregian Hills. These hills are the remnants of old intrusive masses which now stand well above the plain of softer clays which were eroded more easily than the intrusive masses. Another example of a Monteregian Hill is St. Bruno Mountain.

North and west of Ile Jésus are the Laurentian Hills which are part of the Canadian Shield, bounded on the south by a fault line which may be seen in the vicinity of New Glasgow.

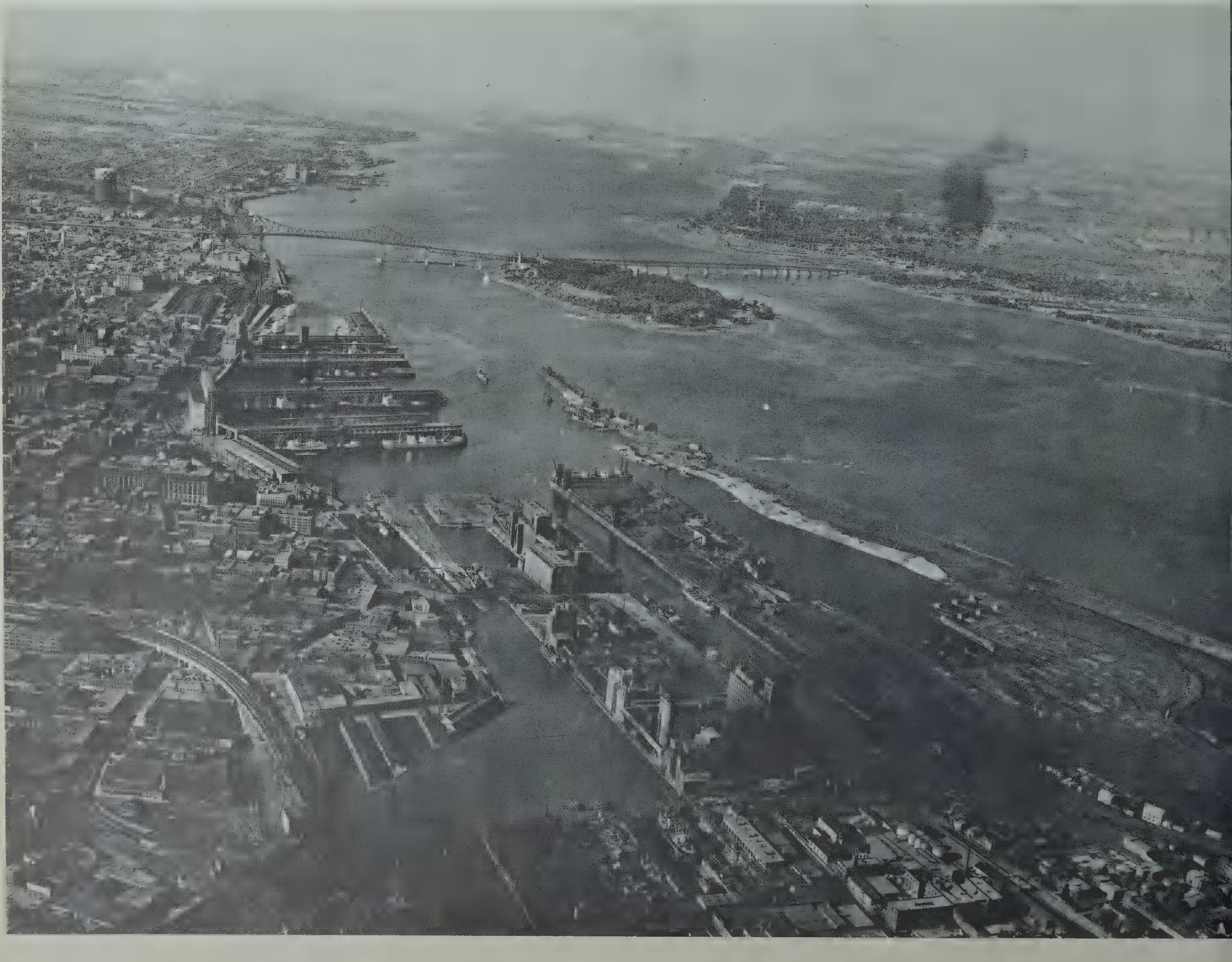
Human Geography

The greatest concentration of population within the area covered by this map is on the Ile de Montréal. Four factors, which are apparent from a study of the map, influenced the choice of the island as a site for settlement:

1. the Lachine Rapids, which marked the limit of navigation;
2. the possibility of excellent communications in all directions from the island;
3. Mont Royal, which offered a good defensive position;
4. the existence of good agricultural land, especially to the south of the island.

The Lachine Rapids made Montreal famous throughout the world as a great inland port, and dictated to some extent the location of the dock facilities, which are to the east of Mont Royal along the St. Lawrence. Although subsequent canal building permitted navigation further upstream and into the lakes, additional dock facilities were built downriver from the original docks because the Lachine Canal was built only for lake boats. The

MONTREAL 2



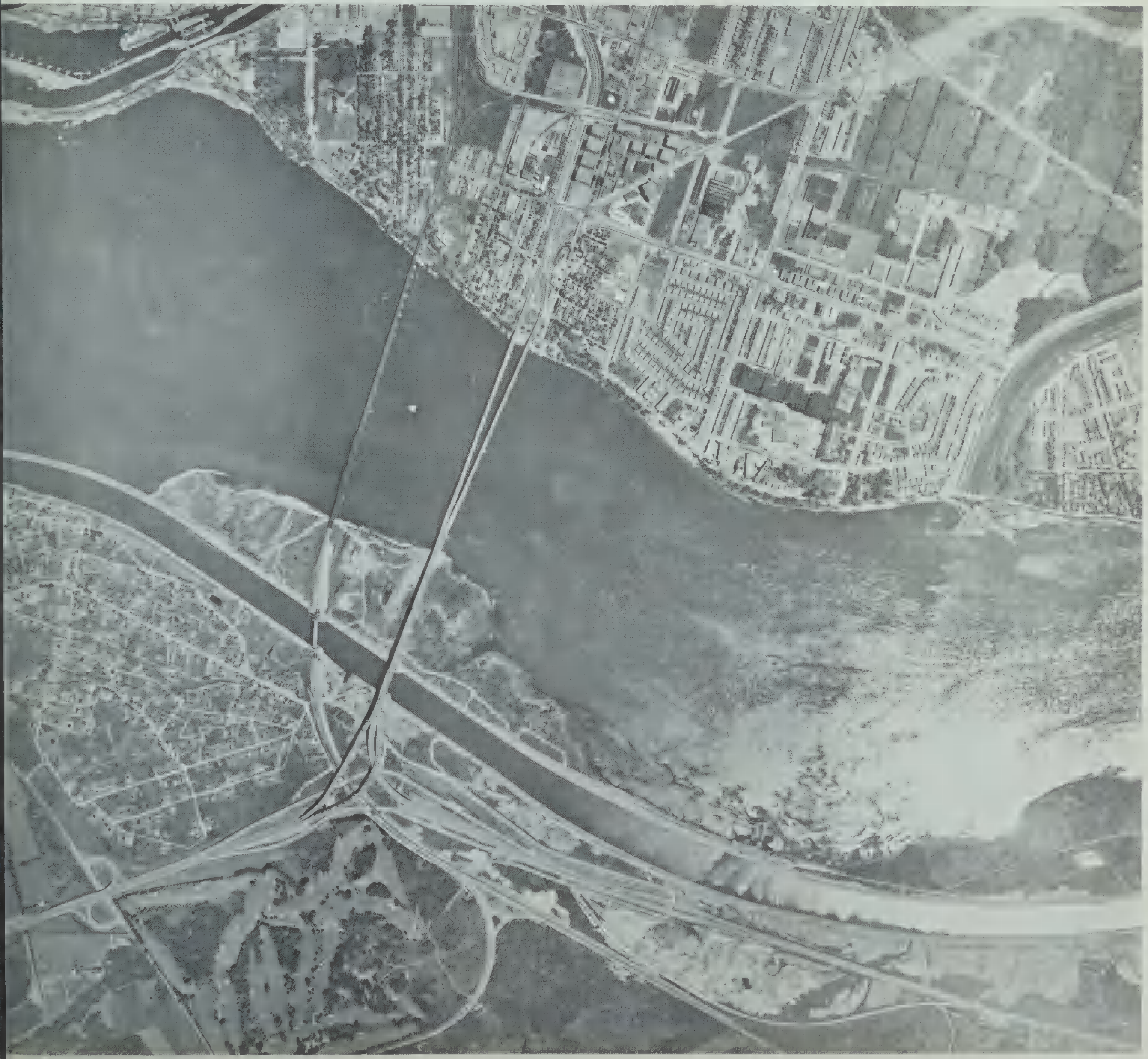
Lachine Canal and the dock facilities can clearly be seen on the town plan.

Montreal is the largest railway centre in Canada. The city is served by both the Canadian National and Canadian Pacific railways, and is the headquarters of these companies. The New York Central Railway also has a terminus in the city. The main routes use the following corridors: the Ottawa River; upriver along the St. Lawrence and lower lakes; downriver along the St. Lawrence; to the south along the Richelieu River and Lake Champlain; and to the south-east through the Eastern Townships. The railway and highway bridges cross the river at its narrowest point. The railway stations are located on the terraces above the canal basin and the main docks. Therefore rail, road, dock and inland waterway terminals are close together. Because of the absence of large areas of level land between Mont Royal and the docks, and because of heavy early settlement, the C.N.R. marshalling yards are to the west in Côte St.-Luc, with smaller yards near the docks. The Canadian Pacific has utilised vast areas of ill-drained but cheap land on the mainland near Bouchard.

Highway #2 crosses the river to Ile de Montréal from the west at St. Anne de Bellevue and follows the river terrace on the south and east sides, crossing to the mainland on the northeast at Bout-d-l'Ille. The Trans-Canada Highway has been interrupted by Mont Royal. The Canadian National Railway solved this problem of Mont Royal by building a four-mile tunnel. It is hoped that elevated expressways will solve the traffic problem and serve to link up the Trans-Canada Highway.

The highest point in the city is Mont Royal; from the river front to the higher slopes of Mont Royal land use is characterized by an altitudinal zonation. Along the waterfront are large ware-

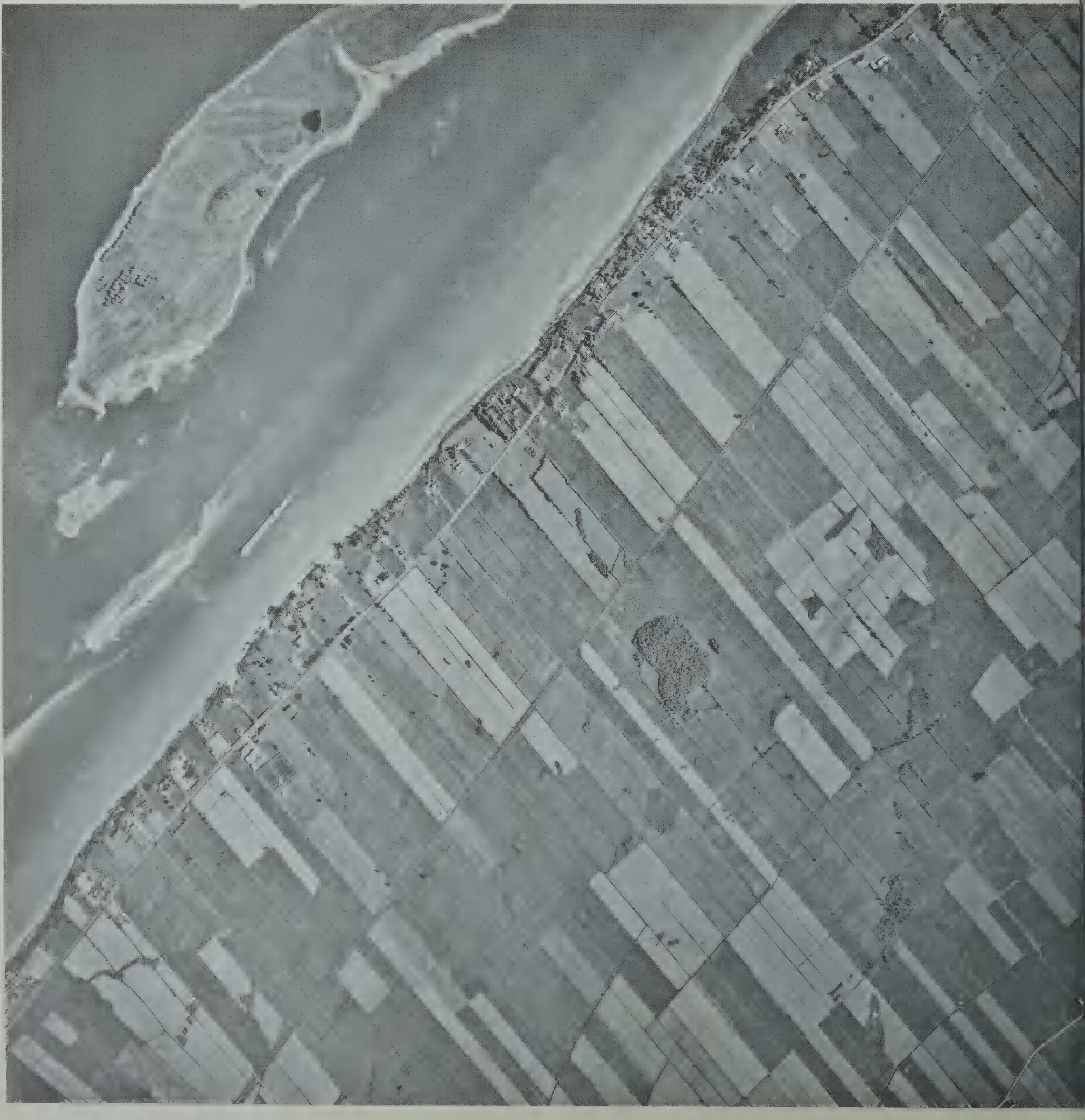
MONTREAL 3



houses, grain elevators, shipyards and heavy industries; the river terraces are occupied by large businesses; and on the hillside are situated some of the residential areas. Both Westmount and Outremont, two of the better residential districts within the city, are located here, and derive their names from their position on Mont Royal. Above all towers the mountain from which the city takes its name.

Although the Montreal Plain to the south and east of the main island is the most densely settled part of Canada, there are few large urban settlements or villages. The reason for the absence of concentrated settlement lies in the past. The land was settled by Frenchmen in the pattern of the long lot or seigneury, with frontage on either road or river, and elongated fields stretching back at right angles to the communication system. This pattern accounts for the lack of nucleated villages in the English style, which form the core for the development of larger settlements. An example of this lineal pattern of settlement is the area to the west of Candiac along the St. Lawrence; its nature can be clearly seen from the aerial photograph (Photograph No. 4). The land use in this type of settlement was, and remains, largely agricultural.

MONTREAL 4



The remnants of the early Indian settlement at the Lachine Rapids (Hochelaga) is now enclosed within the Caughnawaga Indian Reserve.

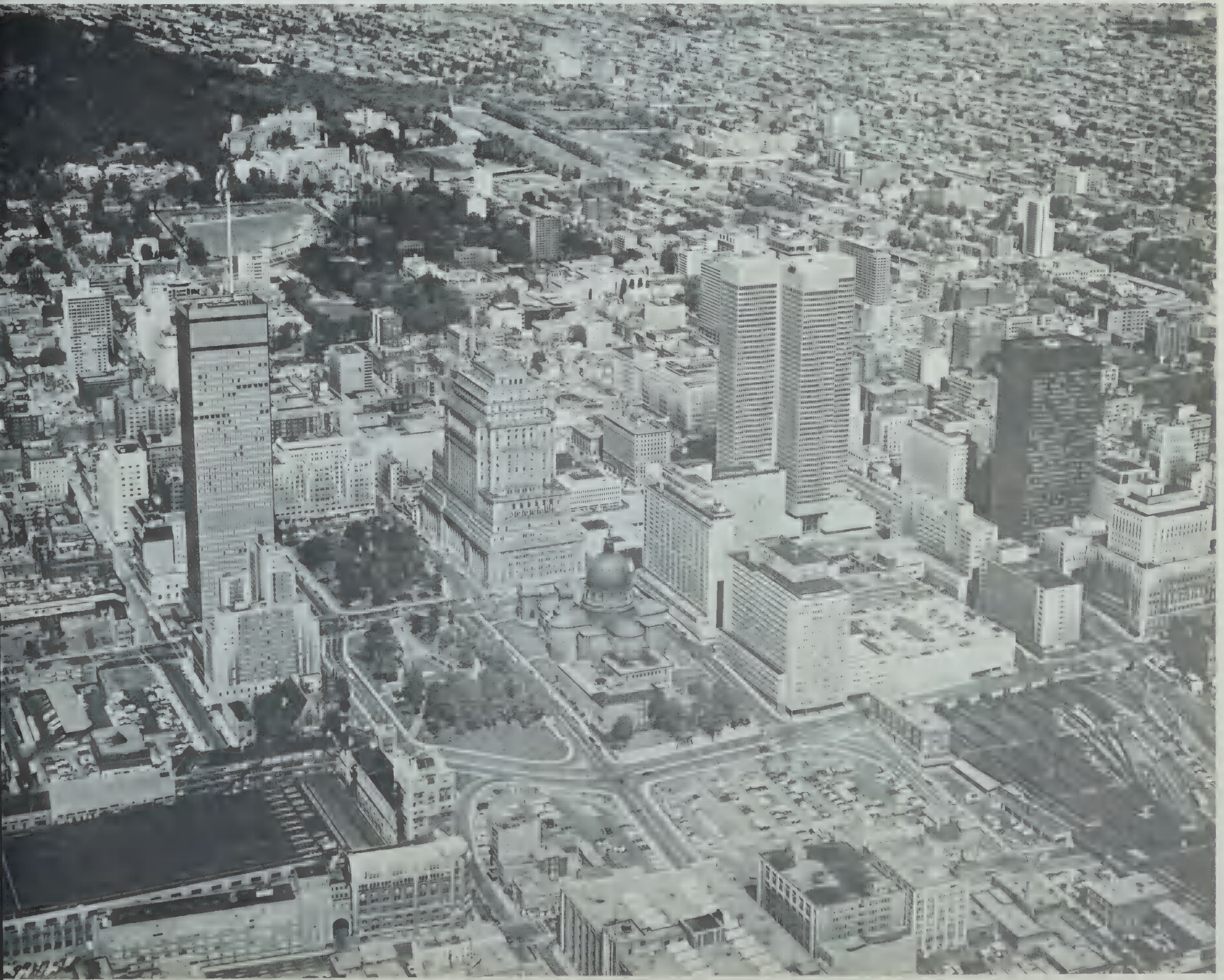
On the mainland to the north, the settlement pattern is quite different. Here the poorly drained areas have been left heavily wooded, and the settlements are associated with forest industries. The marshalling yards of the Canadian Pacific Railway are also in this area.

In the southwest of the map the huge Beauharnois Power development supplies the Greater Montreal area, as well as other regions, with hydro-electricity. This supply of electricity induced many industries, notably chemical, electro-metallurgical, and textile industries, to move into the area.

Assignment

1. (*a*) Find the area in square miles of the map and of the town plan.
   (*b*) Identify the area shown on Photograph 1 on the town plan, and find the square-mile area of Photograph 1.
   (*c*) Draw a section or profile from the west slope of Mont Royal to the edge of the map at St. Bruno Mountain. Use a vertical interval of $\frac{1}{8}$" to 100′. Account for the formation of the mountains involved.

MONTREAL 5



2. (*a*) Locate on the map the docks shown on Photograph 2 and the town plan. Suggest reasons for the location of the docks.
   (*b*) Name the bridge and the island shown on Photograph 2.
   (*c*) Why is the west side of the bridge more elevated than the east side?
   (*d*) Locate on the town plan and on Photographs 1 and 2: Wellington Basin, Lachine Canal Basin, Windmill Point Basin, and Bickerdike Basin. Where are the canal locks with reference to these basins? Describe, from reference to the map and Photograph 3, the route followed by the Lachine Canal.
   (*e*) Make a list of as many hazards to navigation as you can find on the map and Photographs 3 and 4.
   (*f*) Why was the most easterly branch of the river selected for navigation rather than the Rivière des Prairies or the Rivière des Mille Isles?

3. (*a*) Find examples on the map of railway lines that enter the Ile de Montréal. In what general area do most of these lines terminate? Refer to the town plan and Photograph 1.
   (*b*) Draw a sketch map to show the routes followed by the main railway lines. Suggest a possible destination for each line.
   (*c*) Refer to Photograph 2 and the town plan and name the use of many of the large buildings shown in the vicinity of the docks. With this land use so dominant in this part of the city, what key function made Montreal the great transportation centre that it is?

4. (*a*) In what direction is Photograph 5 facing?
   (*b*) Locate on Photograph 1 the two railway stations shown on Photograph 5. The larger of the two stations is the Canadian Pacific. On which street is the Canadian Pacific office building located?
   (*c*) Name the wooded area in the left background of Photograph 5.
   (*d*) With reference to Photographs 1 and 5 and the town plan, describe the altitudinal zones of land use between the St. Lawrence River and the top of Mont Royal.
   (*e*) Locate on Photograph 5 and name from the town plan the large educational institution shown.
   (*f*) How is the land use zonation shown by colouration on the town plan?
   (*g*) How does the particular location of Mont Royal create a traffic problem for the city?

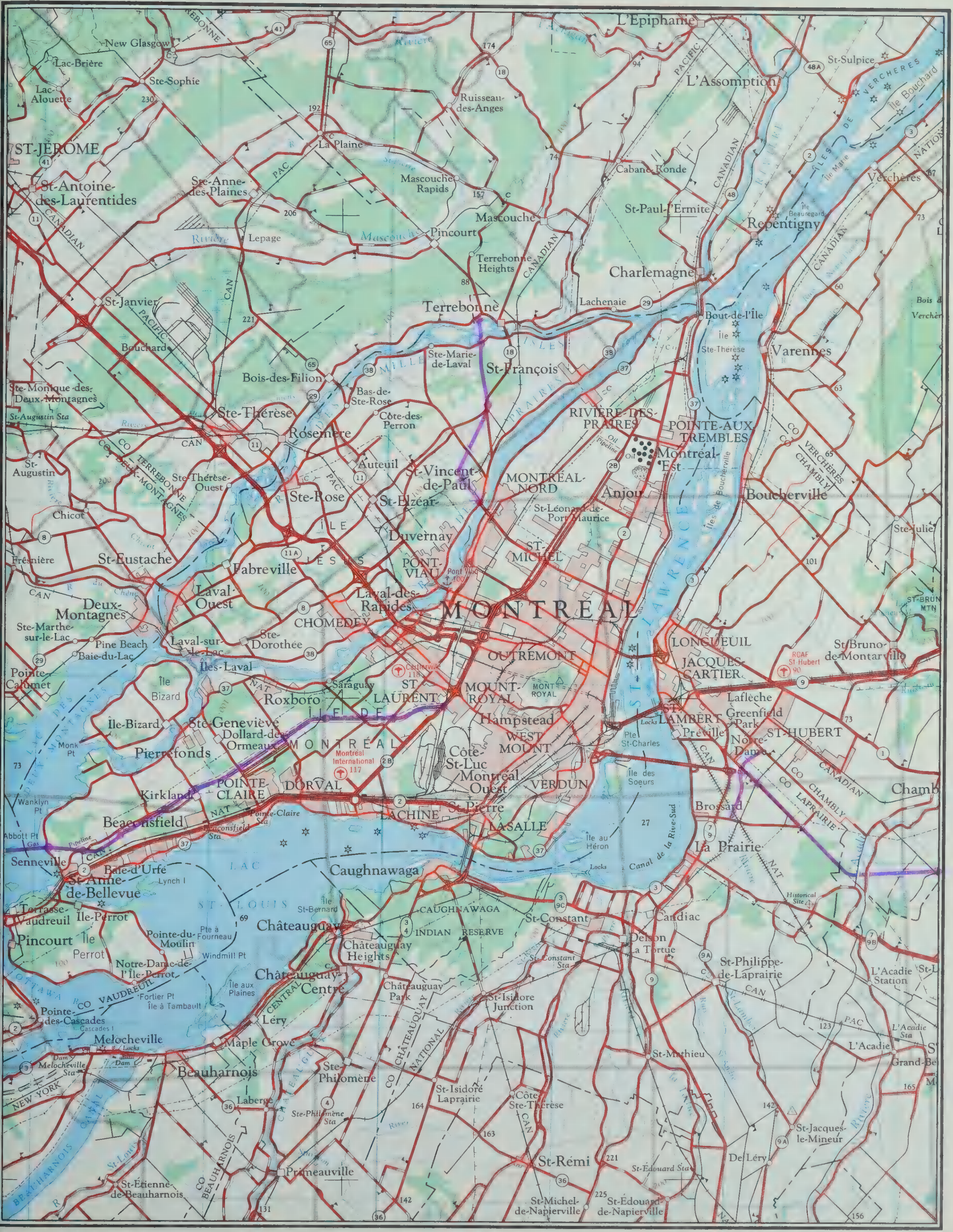
5. (*a*) Why is the area south and east of the islands better for agriculture than the area to the north and west?
   (*b*) Suggest farming activities in (i) the mainland on the south and east, (ii) Ile Jésus, (iii) the mainland to the north.

6. The area shown on Photograph 4 is on the right bank of the river in the vicinity of Verchères.
   (*a*) What is the most distinctive feature about the settlement pattern on this photograph?
   (*b*) What was the advantage of this arrangement in the past?
   (*c*) What is the most distinctive feature of the land use pattern?

7. Montreal is the largest city in Canada. From a study of the map, plan, and photographs, what factors, in addition to the commercial functions already mentioned, do you think have combined to make Montreal a major industrial city?

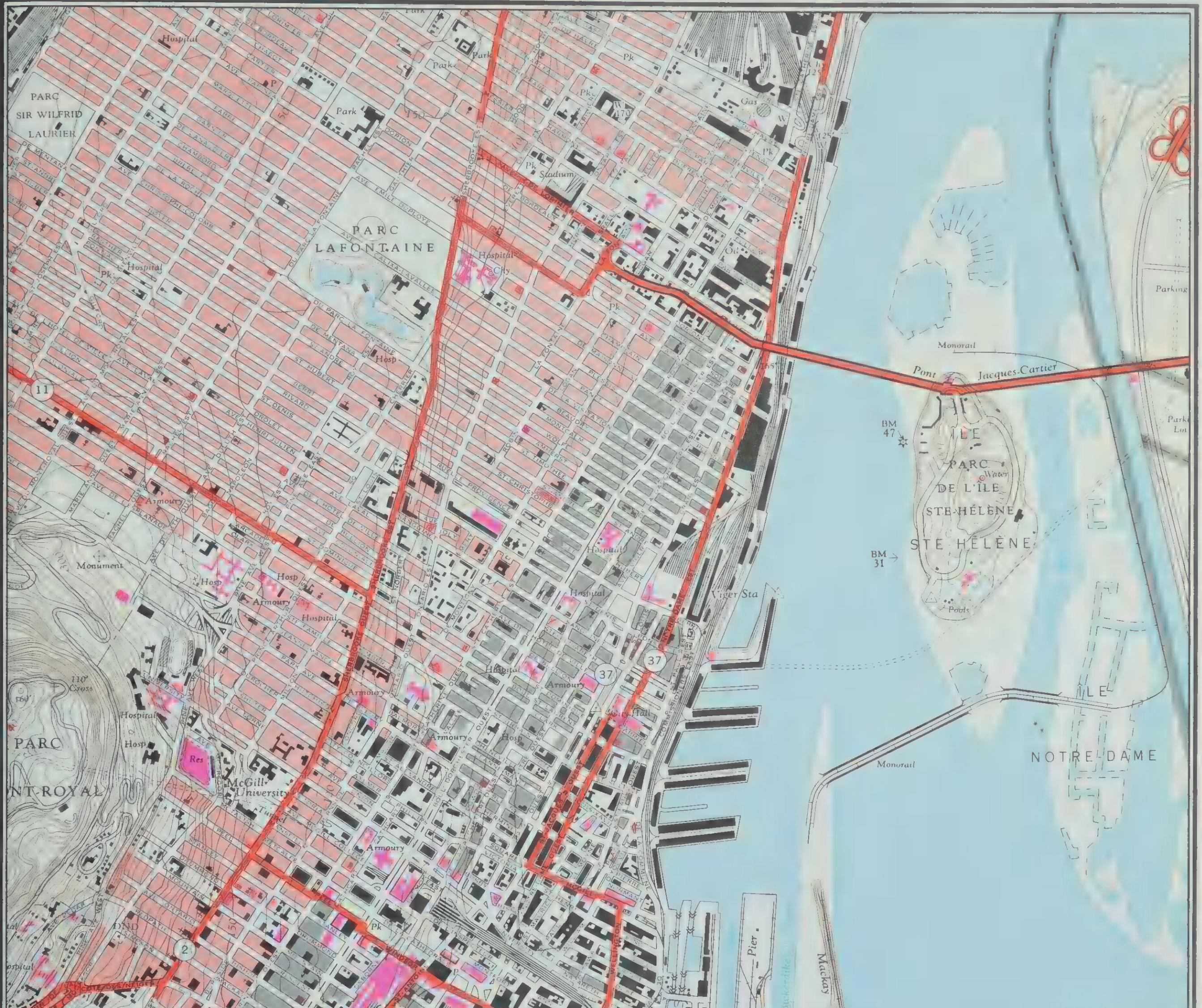
MONTREAL

Scale 1: 250,000


New Glasgow
Lac-Brière
Ste-Sophie
Lac-Alouette
L'Epiphanie
St-Sulpice
L'Assomption
Ruisseau-des-Anges
VERCHERES
Île Bouchard
ST-JEROME
La Plaine
St-Antoine-des-Laurentides
Ste-Anne-des-Plaines
Mascouche Rapids
Cabane-Ronde
Verchères
St-Paul-l'Ermite
Repentigny
Mascouche
Pincourt
Lepage
Terrebonne Heights
Charlemagne
Lachenaie
St-Janvier
Terrebonne
Bout-de-l'Île
Varennes
Bouchard
Ste-Marie-de-Laval
St-François
Ste-Thérèse
Bois-des-Filion
Ste-Monique-des-Deux-Montagnes
St-Augustin Sta
Bas-de-Ste-Rose
Côte-des-Perron
RIVIÈRE-DES-PRAIRIES
POINTE-AUX-TREMBLES
Montréal-Est
Ste-Thérèse
Rosemère
St-Augustin
Ste-Thérèse-Ouest
Auteuil
St-Vincent-de-Paul
MONTRÉAL-NORD
Anjou
Boucherville
Chicot
Ste-Rose
St-Elzéar
St-Léonard-de-Port-Maurice
Duvernay
Ste-Julie
Fresnière
St-Eustache
Fabreville
PONT-VIAU
ST-MICHEL
Laval-Ouest
Laval-des-Rapides
MONTREAL
Deux-Montagnes
CHOMEDEY
Ste-Marthe-sur-le-Lac
Pine Beach
Baie-du-Lac
Laval-sur-le-Lac
Ste-Dorothée
OUTREMONT
LONGUEUIL
St-Bruno-de-Montarville
JACQUES-CARTIER
Pointe-Calumet
Îles-Laval
Île Bizard
Saraguay
ST-LAURENT
MOUNT-ROYAL
Roxboro
Lafleche
Greenfield Park
ST-LAMBERT
Île-Bizard
Ste-Geneviève
Dollard-des-Ormeaux
Hampstead
Préville
ST-HUBERT
Pierrefonds
MONTRÉAL
Montréal International
WEST MOUNT
Notre-Dame
Côte-St-Luc
Montréal-Ouest
Kirkland
POINTE-CLAIRE
DORVAL
VERDUN
Wanklyn Pt
Île des Soeurs
Brossard
Beaconsfield
LACHINE
St-Pierre
LASALLE
Abbott Pt
Senneville
Baie-d'Urfé
Ste-Anne-de-Bellevue
Caughnawaga
La Prairie
Canal de la Rive-Sud
LAC ST-LOUIS
Terrasse-Vaudreuil
Île-Perrot
Châteauguay
CAUGHNAWAGA INDIAN RESERVE
St-Constant
Candiac
Pincourt
Pointe-du-Moulin
Delson
La Tortue
Notre-Dame-de-l'Île-Perrot
Châteauguay Heights
St-Philippe-de-Laprairie
L'Acadie Station
Châteauguay-Centre
Châteauguay Park
St-Isidore Junction
Pointe-des-Cascades
Léry
Melocheville
Maple Grove
L'Acadie
Beauharnois
Ste-Philomène
St-Mathieu
St-Isidore-Laprairie
Côte-Ste-Thérèse
Laberge
St-Jacques-le-Mineur
St-Rémi
De Léry
Prineauville
St-Étienne-de-Beauharnois
St-Michel-de-Napierville
St-Édouard-de-Napierville
ST LAWRENCE
RIVIÈRE DES PRAIRIES
RIVIÈRE DES MILLE ÎLES
LAC DES DEUX MONTAGNES
BEAUHARNOIS CANAL
CANADIAN PACIFIC
CANADIAN NATIONAL
NEW YORK CENTRAL

MONTREAL TOWN PLAN

Scale 1: 25,000


PARC
SIR WILFRID
LAURIER
PARC
LAFONTAINE
Stadium
Park
Pk
Hospital
Hosp
Gas
Oil
150
125
Monorail
Pont Jacques-Cartier
BM
47
ILE
PARC
DE L'ILE
STE-HELENE
Water
STE HELENE
BM
31
Pools
Parking
Viger Sta
37
11
2
ST DENIS
ST HUBERT
ST ANDRE
ILE
NOTRE DAME
Monorail
Monument
110°
Cross
PARC
NT-ROYAL
Res
McGill
University
Tunnel
Armoury
Hall
Pier
Bickerdike
Pier
Mackay
Pier
280
Victoria
Bridge
DE LA FERME
LA CONGREGATION
STE MADELEINE
CHARON
Parking Lot
Pointe St-Charles
LEBER
PARK
Oil
Chimney
Park
Tunnel
Montreal
CAN

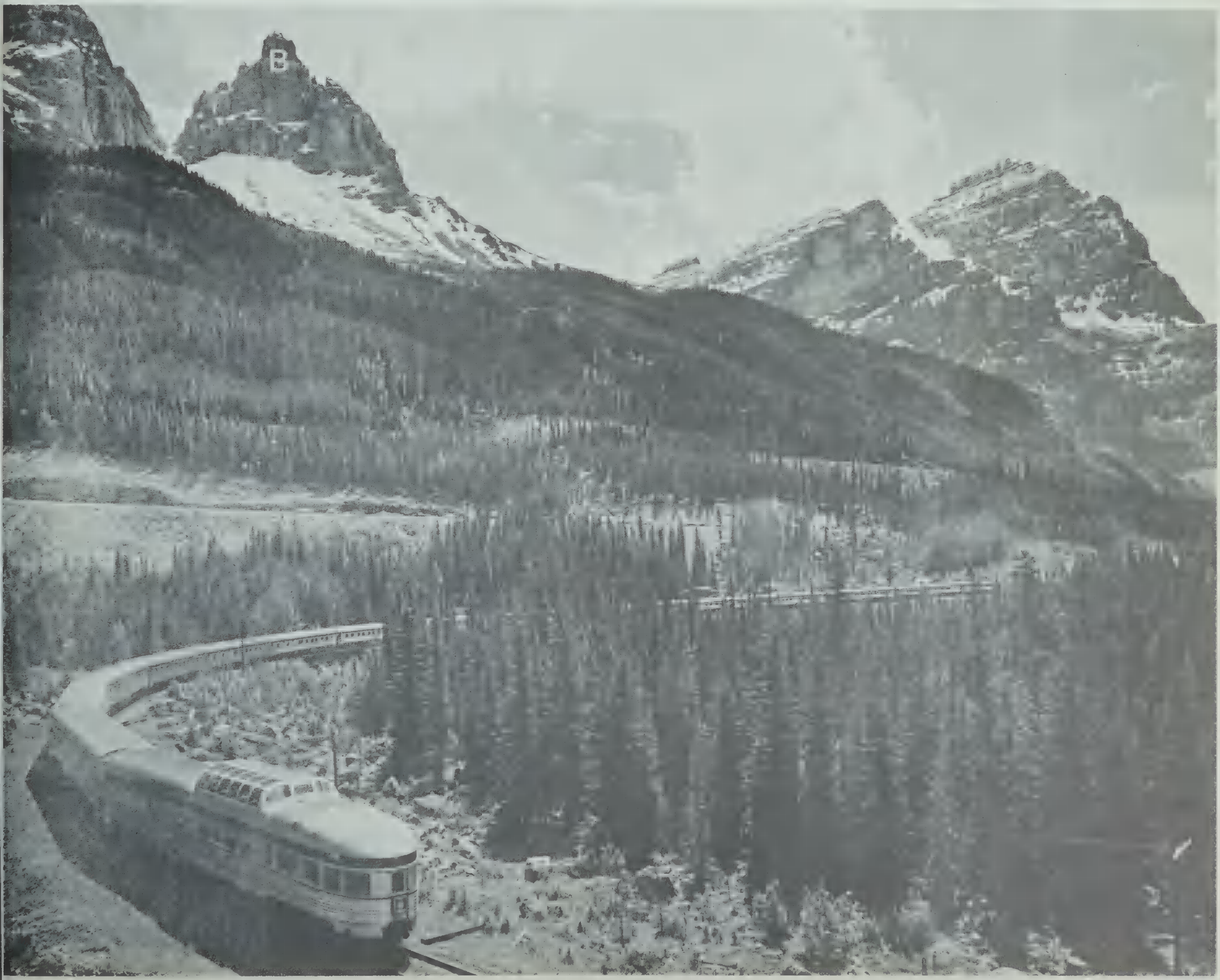
LAKE LOUISE

Most of the area shown on this map is in British Columbia, with a small part of Alberta appearing in the east. Lake Louise itself does not appear as it is about four miles east of the eastern edge of the map.

Assignment

1. What is the square mile area of the map?
2. (*a*) What is the distance from Yoho to the summit of Mount Stephen?
   (*b*) Why would the walking or true distance between these two places exceed the map distance?

LAKE LOUISE 1



3. (*a*) What evidence is there on the map and Photograph 1 of the type of rock of which this area is composed?
   (*b*) What evidence is there of the manner in which these mountains were originally created? Refer to both map and Photograph 1.

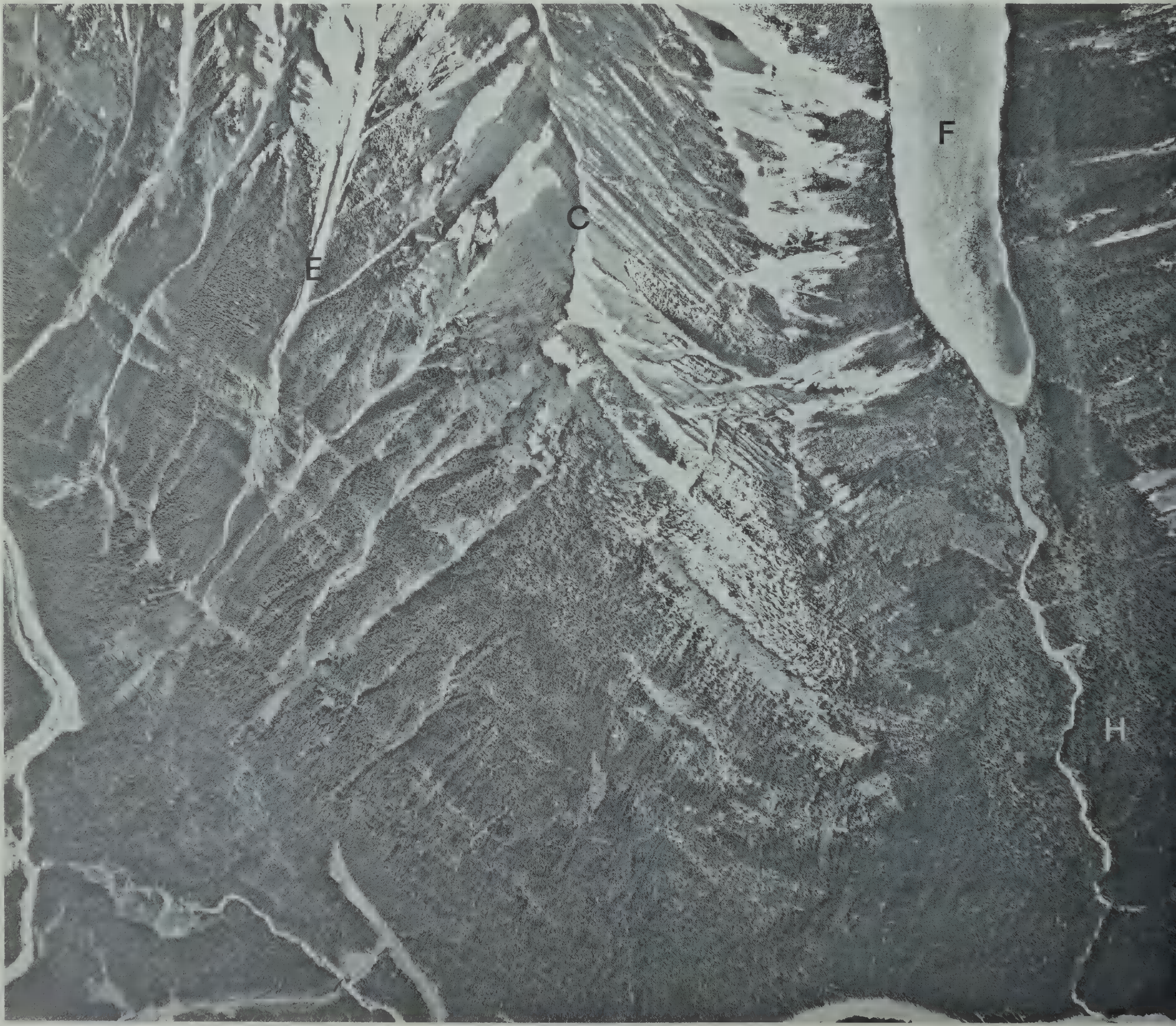
4. (*a*) Locate Photograph 2 on the map, naming the mountain and lake.
   (*b*) What is the main watershed shown on Photograph 2? What type of glacial feature is this?

5. (*a*) Find the grid references for: Hector near Wapta Lake, Yoho, the summit of Pope's Peak, Fire Lookout Tower.
   (*b*) What are the glacial features indicated by the following grid references?
      (i) 415935
      (ii) 426939
      (iii) 477965
      (iv) 443998
      (v) 426005
      (vi) 398964
      (vii) 374954
   (*c*) Identify the glacial features indicated by capital letters on the photographs.
      A (Photograph 3)
      B (Photograph 1)
      C (Photograph 2)
      D (Photograph 3)
      E (Photograph 2)
      F (Photograph 2)
      G (Photograph 4)
      H (Photograph 2)
      J (Photograph 3)

6. Find the level at which the ice melts on the north and south side of Mount Stephen. Explain the difference.

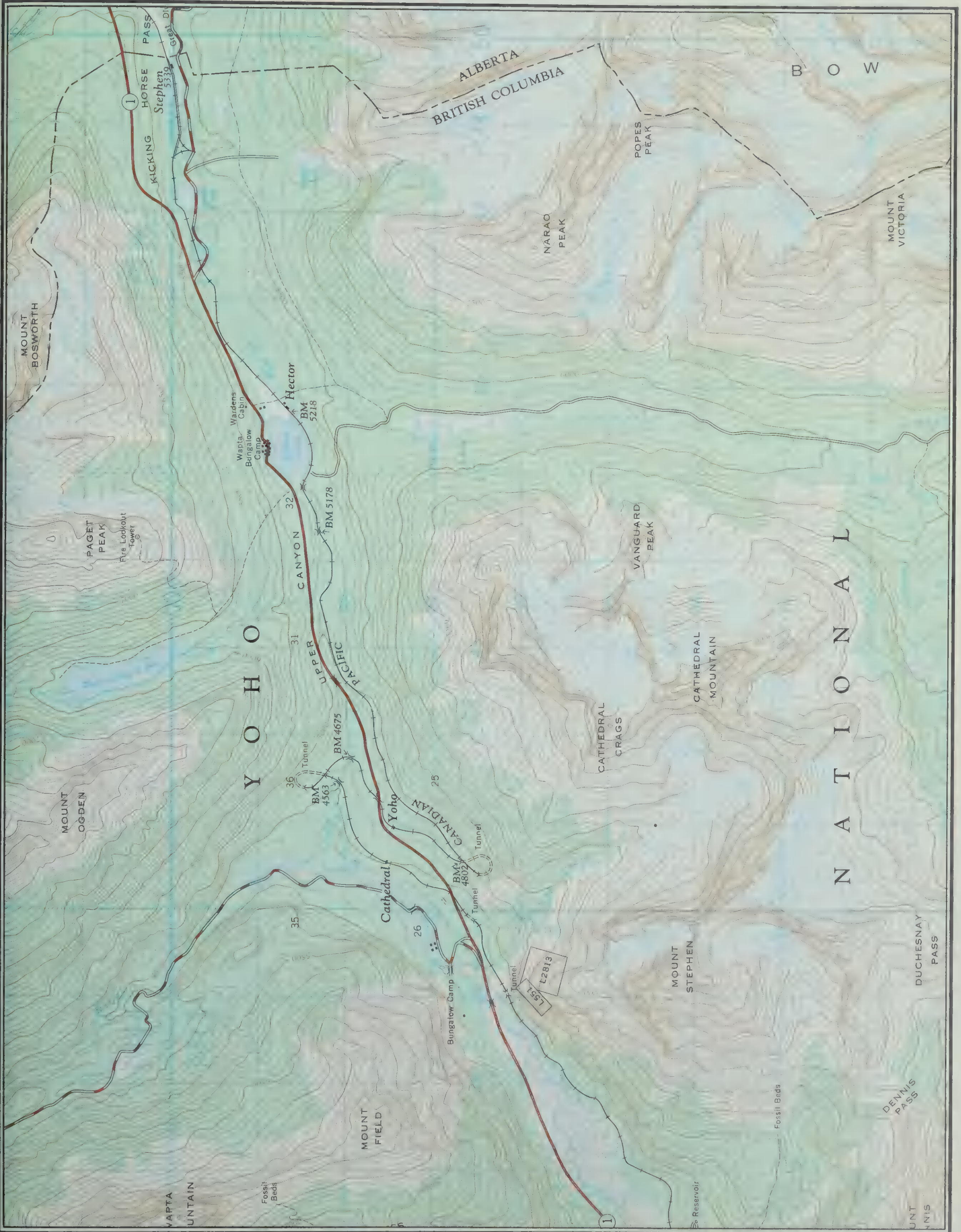
7. (*a*) Account for the swamp conditions found along Cataract Creek.
   (*b*) Why are the Narao Lakes intermittent?
   (*c*) Draw a cross section or profile from grid reference 365955 to grid reference 385945. Label the main features shown on the profile. Use every fifth contour only, and a vertical scale of $\frac{1}{8}$ in. to 100 ft.

LAKE LOUISE 2



LAKE LOUISE ←

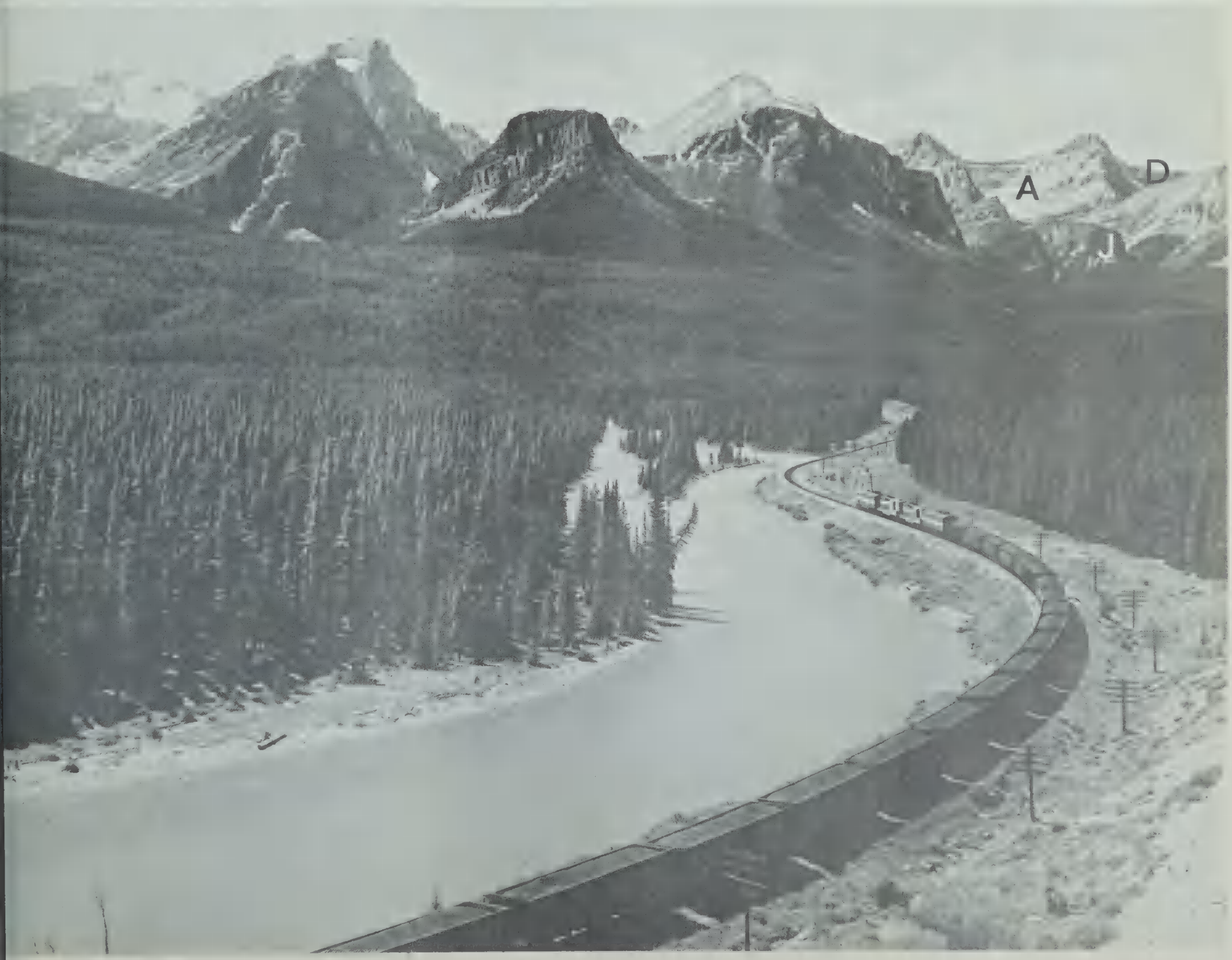
Scale 1: 50,000


ALBERTA
BRITISH COLUMBIA
B O W
POPES PEAK
NARAO PEAK
MOUNT VICTORIA
KICKING HORSE PASS
Stephen
5339
Great Di
1
MOUNT BOSWORTH
Hector
BM 5218
Wardens Cabin
Wapta Bungalow Camp
32
BM 5178
PAGET PEAK
Fire Lookout Tower
CANYON
UPPER
PACIFIC
Y O H O
N A T I O N A L
VANGUARD PEAK
CATHEDRAL MOUNTAIN
CATHEDRAL CRAGS
31
36
Tunnel
BM 4675
BM 4563
25
Yoho
CANADIAN
Tunnel
BM 4802
MOUNT OGDEN
Cathedral
35
26
Tunnel
Tunnel
Bungalow Camp
L2813
L551
MOUNT STEPHEN
DUCHESNAY PASS
MOUNT FIELD
Fossil Beds
Fossil Beds
DENNIS PASS
Reservoir
VAPTA UNTAIN
UNT NIS
1

8. (*a*) What kinds of vegetation would you expect to find in this region? Refer to the photographs as well as the map.
   (*b*) What is the average upper limit of natural vegetation on the map? Find two exceptions to this general level and account for them.

9. (*a*) Find the elevation of Kicking Horse Pass in the Great Divide area.
   (*b*) What is the difference in elevation between Kicking Horse Pass and the point where the railway leaves the map at the western edge?
   (*c*) On the map and Photograph 5 study the route followed by a westbound train through the tunnels. Why were these tunnels necessary in the first place? Find the grid reference of the tunnel from which the westbound train on Photograph 5 is emerging. In which direction was the photograph taken?
   (*d*) Through how many feet does a westbound train descend between the entrance of the tunnel found at 404964 and the exit of the tunnel at 416983?

LAKE LOUISE 3

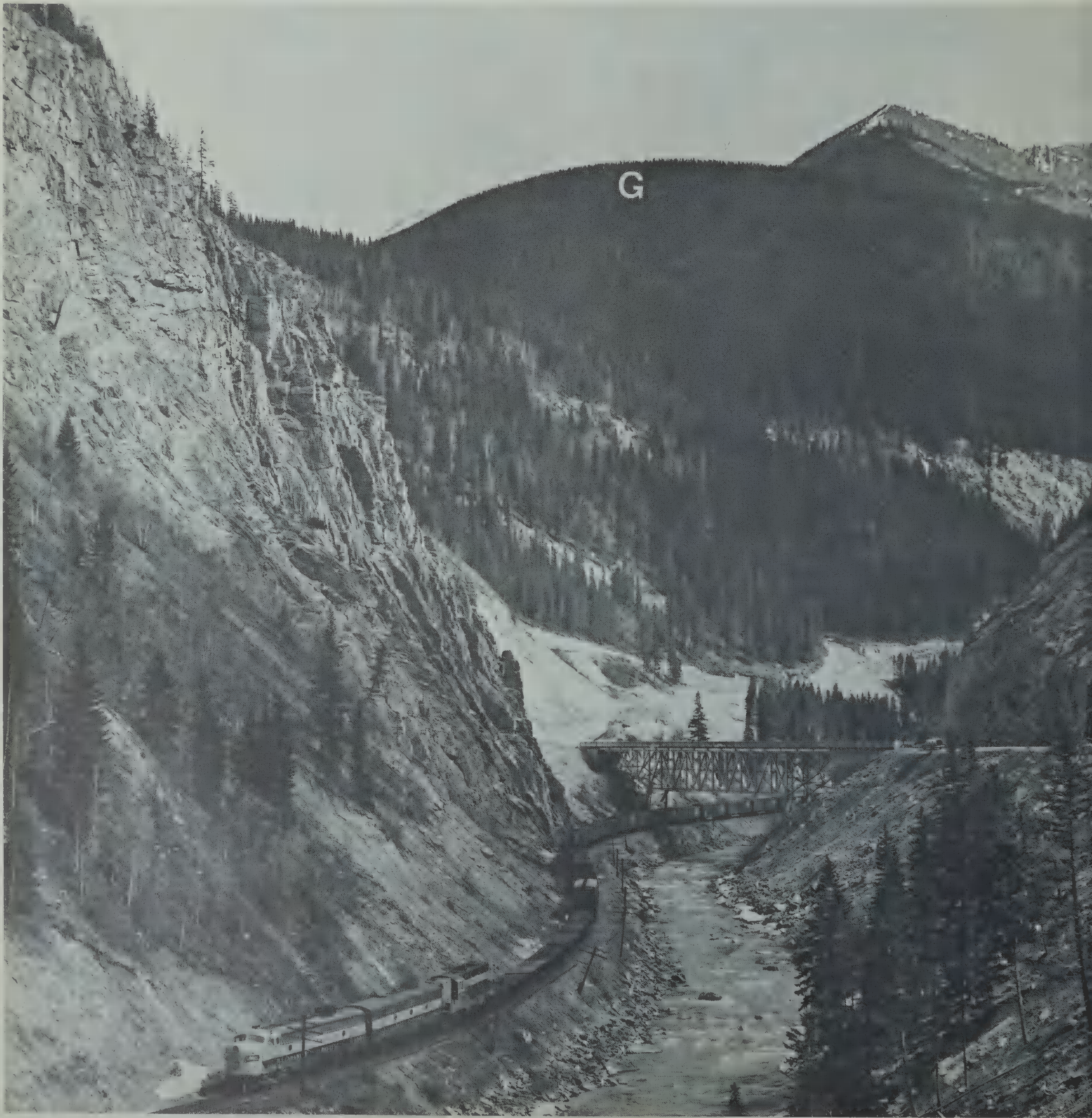


(*e*) What problems did the builders of the railway encounter between the exit of the tunnel at 416983 and the western edge of the map?

(*f*) What locomotive development has lessened the importance of these tunnels?

(*g*) Photograph 4 was taken in the Kicking Horse Canyon. What construction problems were encountered in building both the railway and road? What constant hazards endanger both?

LAKE LOUISE 4

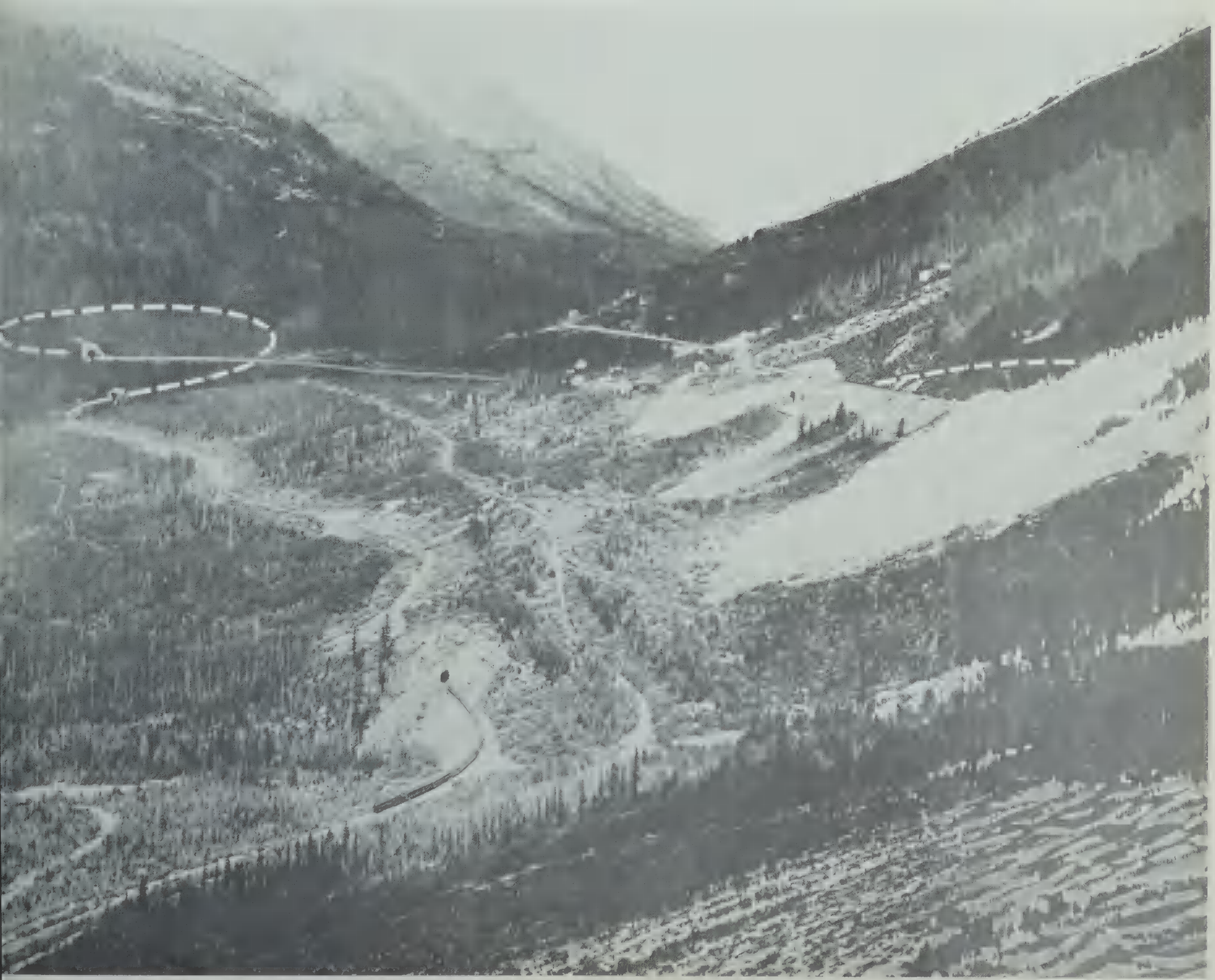


10. Study the boundary between Alberta and British Columbia. List the geographical features the boundary follows.

11. (*a*) What evidence is there on the map that the region has little to offer man?

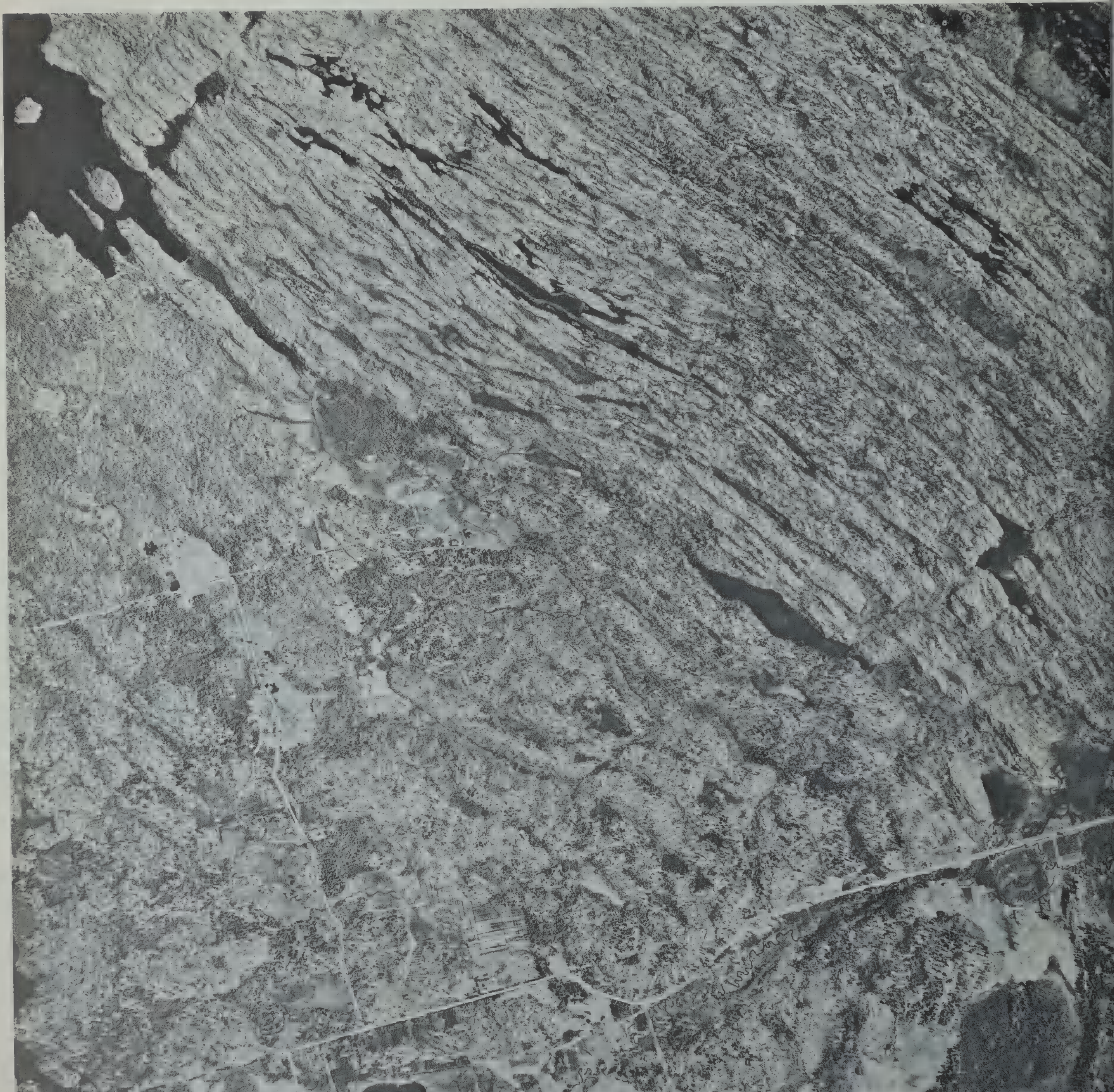
    (*b*) Make as full a list as you can of the ways man has utilised the region. Refer to the train shown on Photograph 3 as well as to the map.

LAKE LOUISE 5



On this map a pictorial effect has been attempted through the use of shading in addition to contouring. The area shown lies between Gravenhurst and Orillia, in the province of Ontario. A small part of the latter city may be seen in the south-central portion of this sheet.

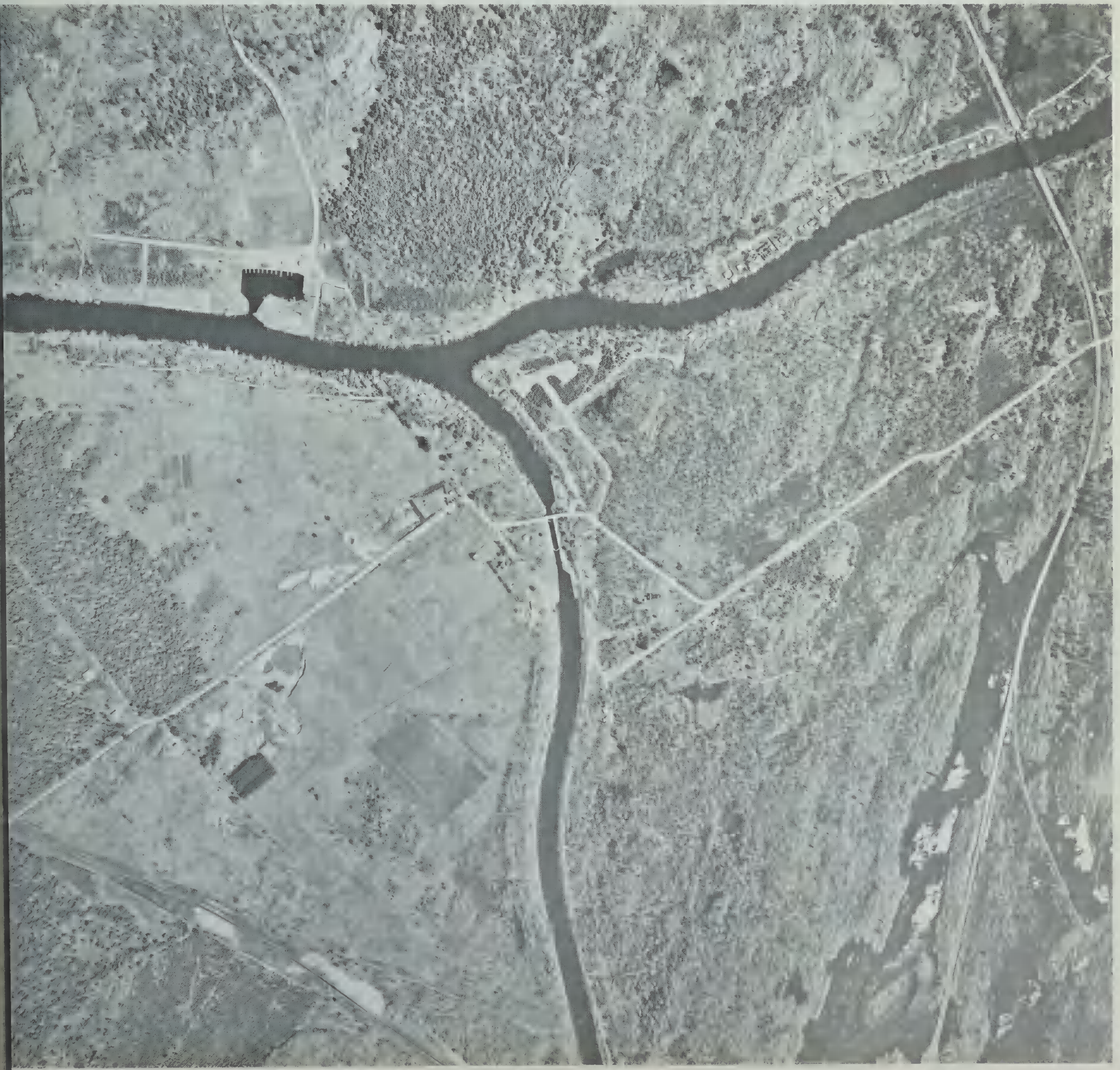
ORILLIA 1



Assignment

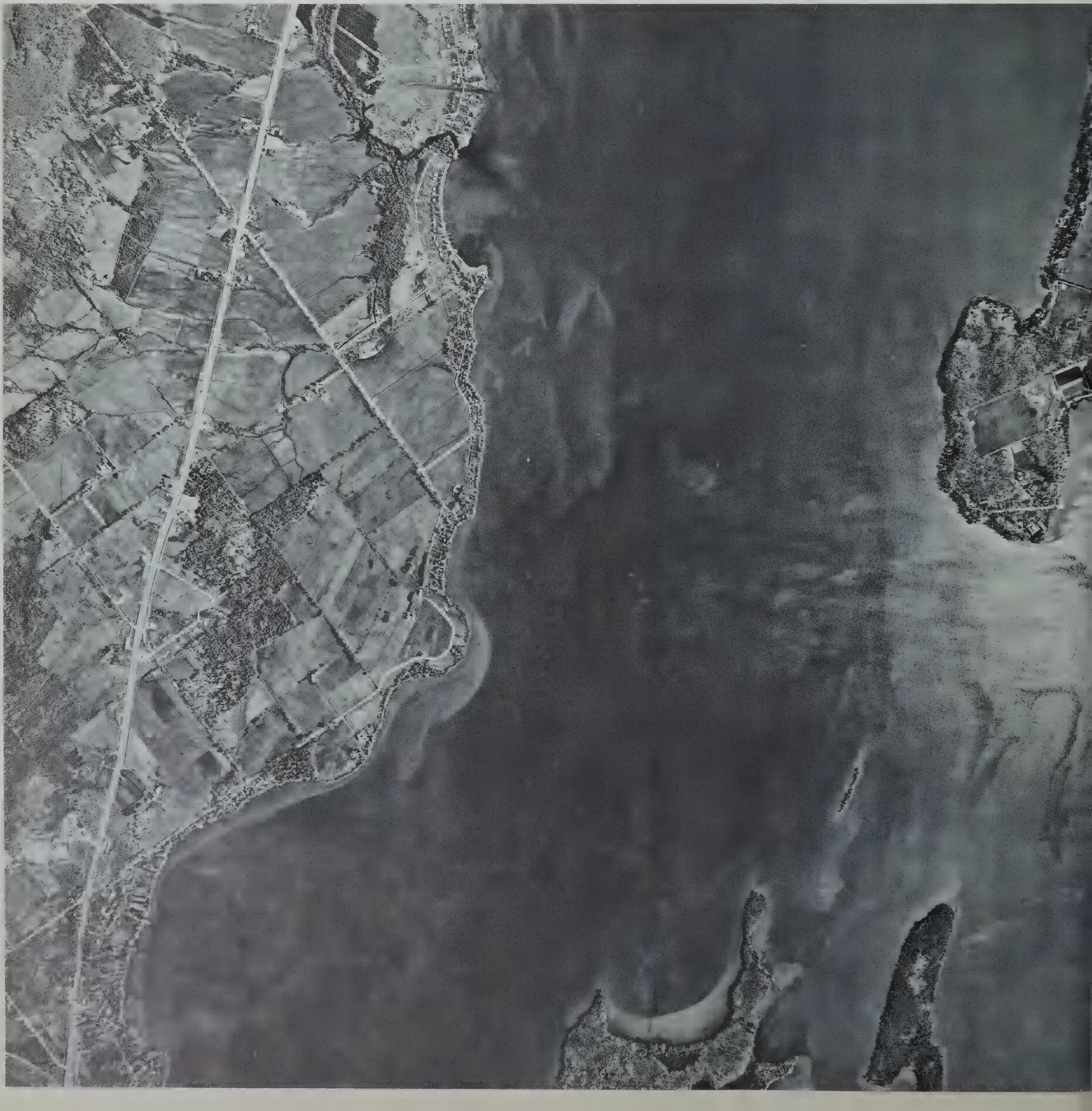
1. (*a*) Express the representative fraction 1:125,000 in terms of inches and miles.
   (*b*) How far is it by main road from Orillia to Gravenhurst?
2. (*a*) State how you could divide this map into two distinct physiographic regions by drawing a line.
   (*b*) Name the areas to the north and south of the line.
   (*c*) Is there anything to indicate that Sparrow Lake and Lake Couchiching may at one time have been linked?

ORILLIA 2



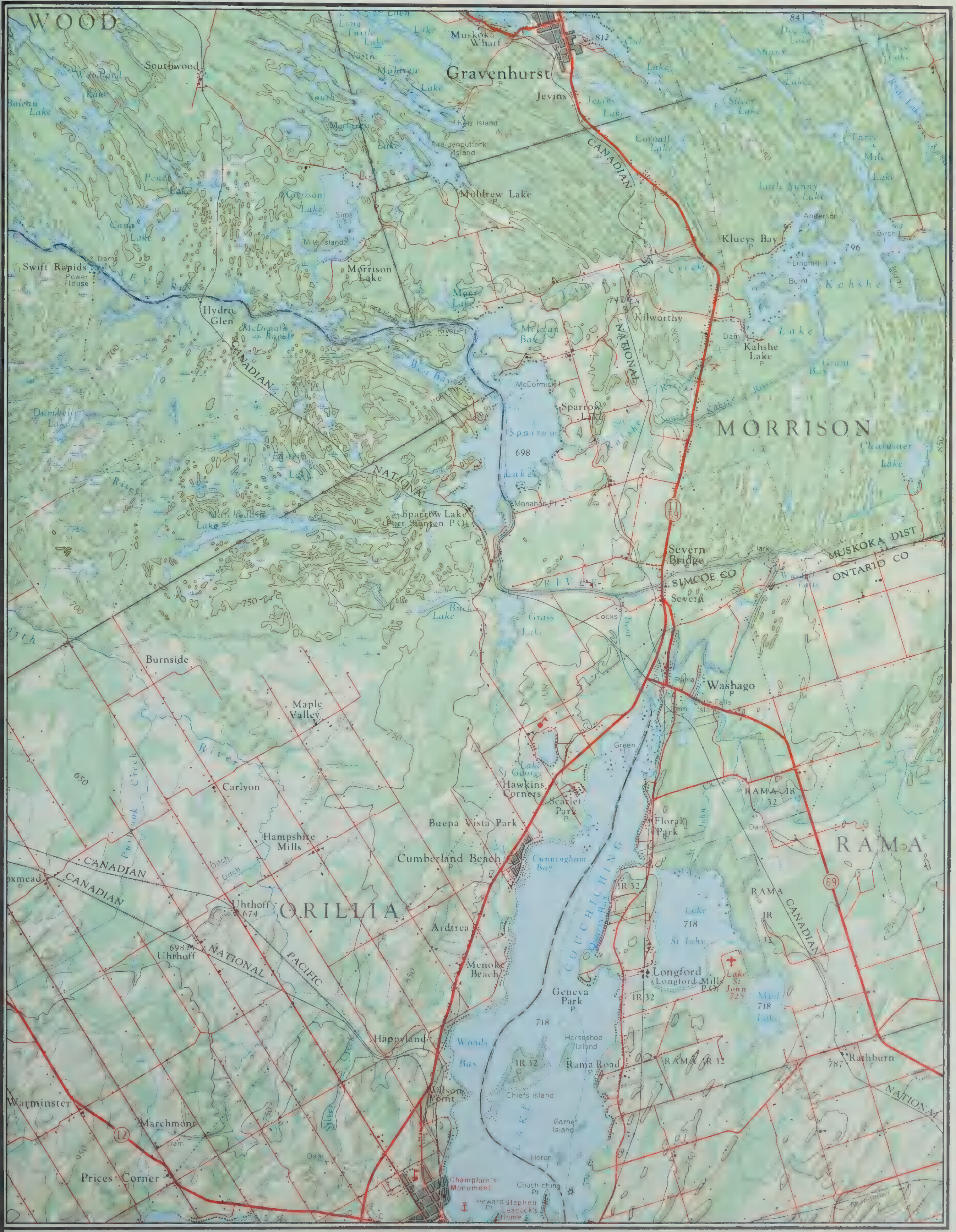
3. (*a*) What differences are apparent in the drainage patterns of the northern and southern parts of the map?
   (*b*) What may be deduced about the bedrock of the northern part of the map?
   (*c*) Locate Photograph 1 on the map, naming the bodies of water shown. Determine the size of the area shown on the photograph. Account for the southward bend in the main east-west road.

ORILLIA 3



ORILLIA

Scale 1: 125,000


WOOD
Southwood
Woodland Lake
Boleau Lake
Muskoka Wharf
Gravenhurst
Jevins
Jevins Lake
Gull Lake
Sunny Lake
Silver Lake
Dock Lake
Three Mile Lake
Kerr Island
Craigenputtock Island
Cornall Lake
CANADIAN
Pence Lake
Morrison Lake
Muldrew Lake
Sims
Mile Island
Little Sunny Lake
Anderson
Kluey's Bay
796
Lindhill
Burnt
Kahshe Lake
Swift Rapids
Power House
Dams
Severn River
Morrison Lake
Moore Lake
Hydro Glen
McDonald Rapids
River Pt
McLean Bay
Jevins Creek
Kilworthy
NATIONAL
Dam
Kahshe Lake
Grant Bay
Dumbell Lake
McCormick
Sparrow Lake
Sparrow Lake
698
Kahshe River
MORRISON
Clearwater Lake
850
NATIONAL
Monahan Pt
Sparrow Lake
Port Stanton P.O.
11
69
Severn Bridge
Clark
MUSKOKA DIST
ONTARIO CO
SIMCOE CO
Severn
Severn River
Locks
Grass Lake
Buck Lake
750
700
Burnside
Maple Valley
Rama
Washago
Little Falls
Green
Lake St George
Hawkins Corners
Scarlet Park
Carlyon
RAMA IR 32
Floral Park
Buena Vista Park
Hampshire Mills
Cumberland Beach
Cunningham Bay
RAMA
CANADIAN
CANADIAN
Foxmead
Uhthoff
674
ORILLIA
IR 32
Lake St John
718
RAMA IR 32
69
Ardtrea
698
Uhthoff
NATIONAL
PACIFIC
Menoke Beach
LAKE COUCHICHING
Longford
Longford Mills P.O.
Lake St John
725
Mud Lake
718
Geneva Park
IR 32
718
Happyland
Woods Bay
Horseshoe Island
IR 32
Rama Road
RAMA IR 32
Rathburn
787
Wilson Point
Chiefs Island
NATIONAL
Warminster
Marchmont
12
Dam
Garnet Island
Heron
Prices Corner
Champlain's Monument
Couchiching Pt
Heward Pt
Stephen Leacock's Home
650
950

4. (*a*) Name the main river draining the northern half of the region. Locate Photograph 2 on the map. Name the two waterways that meet. Compare the square mile area shown on this photograph with that of Photograph 1.

(*b*) How is the difference in the level of Sparrow Lake and Lake Couchiching overcome? Locate this feature on Photograph 2. How is the main river utilised downstream from Sparrow Lake?

(*c*) Study Photograph 2 and identify at least five land uses.

5. (*a*) What does the lineal shading in the northern half of the map indicate?

(*b*) Account for the alignment of lakes in the area as shown clearly on the map and Photograph 1.

(*c*) Account for the convex nature of the more elevated slopes.

6. (*a*) Lake Couchiching was at one time much larger than it is today and was part of Lake Algonquin. Find three ways in which the shrinkage of the lake is reflected by the map and Photograph 3.

(*b*) The area west of Lake Couchiching is a sand plain, whereas the area to the east is predominantly clay. What features on the map would suggest this?

(*c*) From a study of Photograph 3, what type of stream erosion is apparent? Name the main bays shown on the photograph. Identify the main land uses.

7. (*a*) Identify the glacial feature indicated by the elongated 750 ft. contour line east of Couchiching Point in the south of the map. A feature similar to this one may be seen in Photograph 4.

(*b*) Of what materials is this feature composed?

(*c*) Identify the glacial feature immediately east of the dam on St. John Creek.

8. (*a*) Identify: (i) the surface material to be seen in the foreground of Photograph 4, (ii) the glacial feature to be seen in the background of the same photograph.

(*b*) Describe the soil characteristics of the land in the foreground.

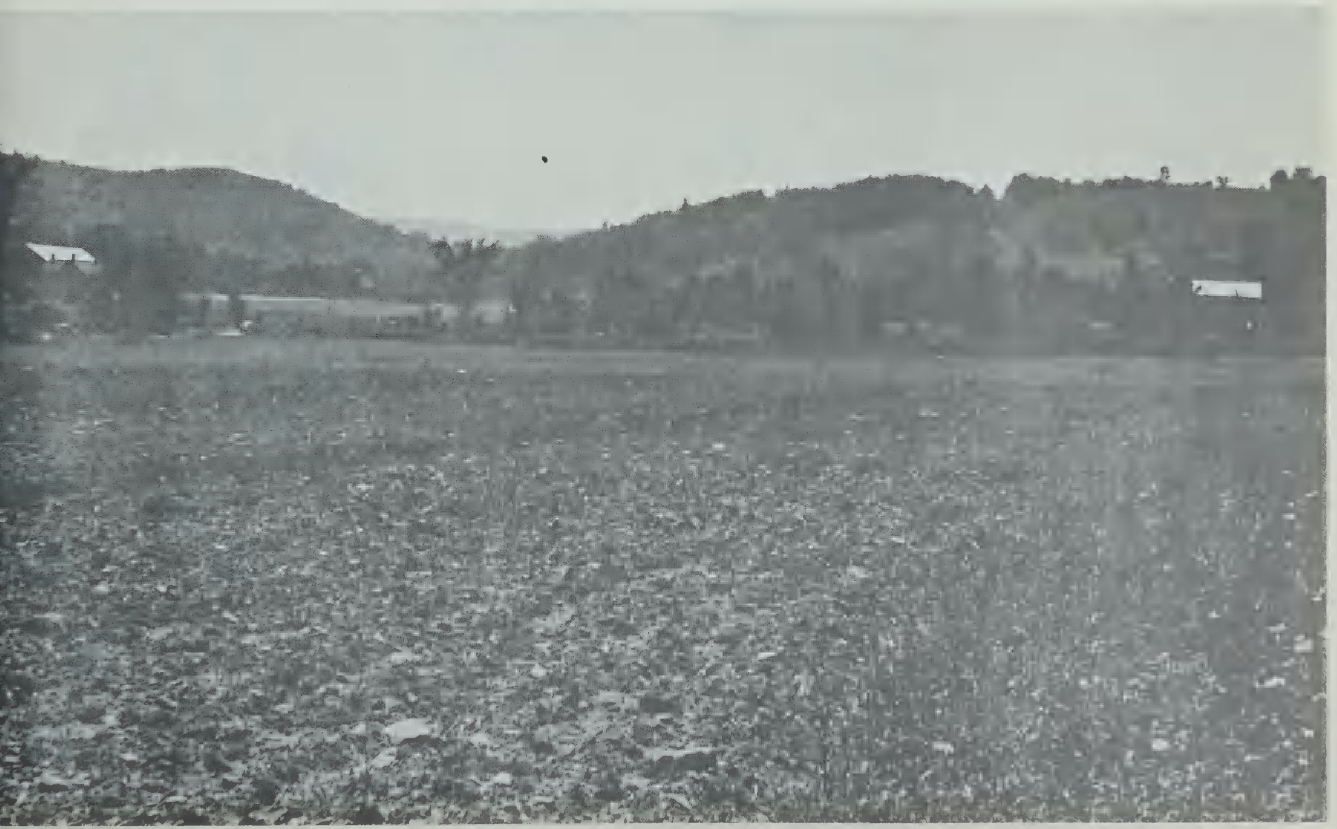
(*c*) How do land uses differ between the elevated and the level land in Photograph 4? Account for any differences observed.

9. (*a*) Compare the road pattern on the northern and southern parts of the sheet.

(*b*) How did the surface features of the two areas bring about the patterns described in part (*a*)?

10. Compare and account for the distribution of population in the northern and southern parts of the map.

ORILLIA 4



MOUNT REVELSTOKE

This map illustrates the effect of colour shading and contouring in an attempt to achieve a three-dimensional view of the landscape.

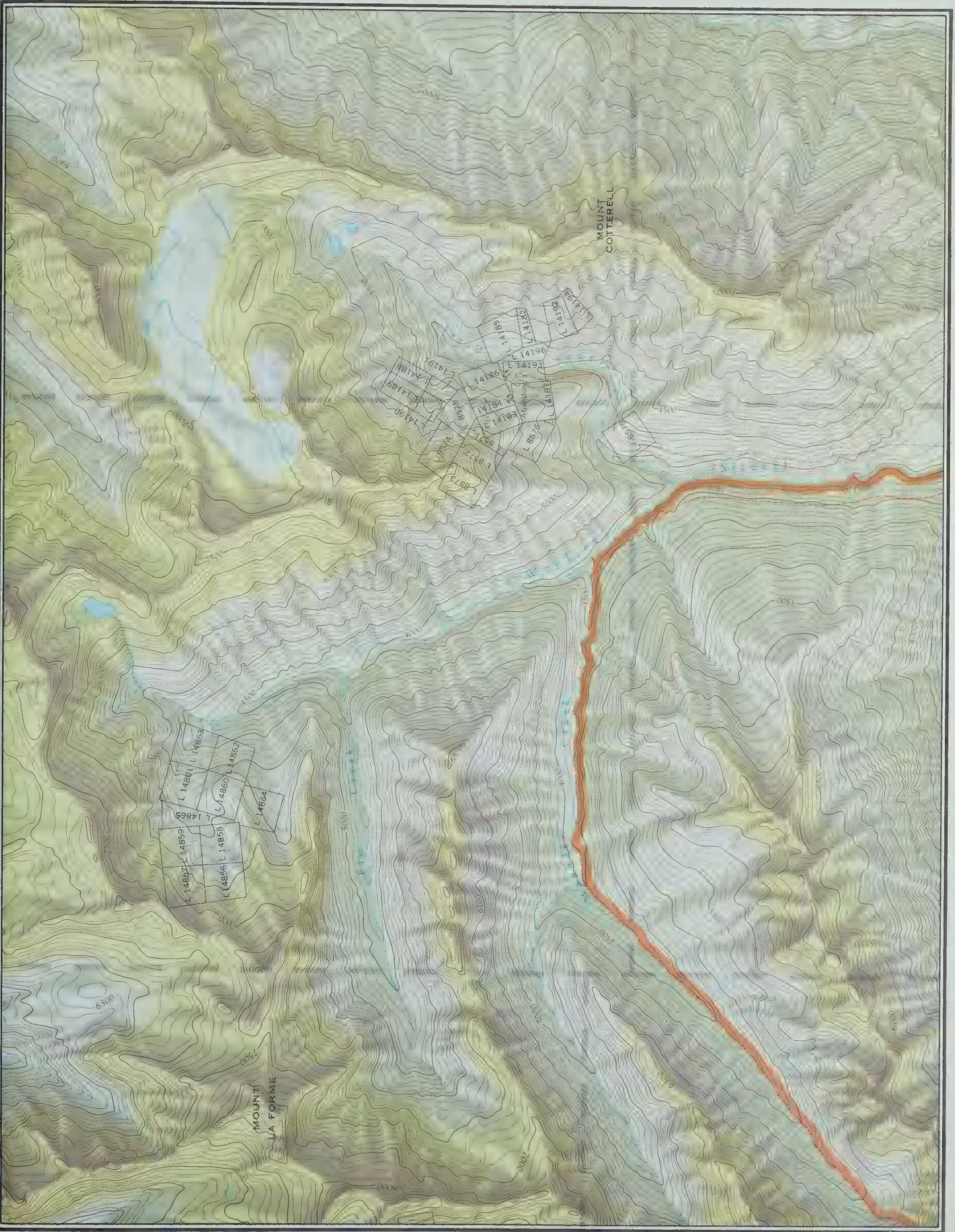
The area is in southern British Columbia and is part of the Selkirk Mountain System, which is composed of highly metamorphosed sedimentary rock. Many large intrusions of igneous rock occurred. Mining camps and concessions are frequently found where igneous intrusions altered the rock composition.

Assignment

1. (*a*) Draw a section or profile of the Woolsey Creek from a point $\frac{1}{2}$ mile east of the W in the name to a point $\frac{1}{2}$ mile west of the W.
   (*b*) How was this valley created?
   (*c*) In what ways is it either typical or not typical of an alpine glaciated valley?
2. (*a*) Find the gradient of the Woolsey Creek from its source to the confluence with the Maunder Creek.
   (*b*) In what stage of the evolutionary process is Woolsey Creek? Justify your answer.
   (*c*) Name the type of drainage pattern which centres on Woolsey Creek.
   (*d*) Considering Woolsey Creek as the consequent stream, find examples of subsequent and obsequent streams.
3. (*a*) Describe the border of the major watershed around Elm Creek.
   (*b*) Account for the intermittent nature of Elm Creek and the large number of dry valleys in the Elm Creek watershed.
4. Find five other examples of alpine glaciation on the map.
5. What signs on the map indicate human activities in the region?

MOUNT REVELSTOKE ←

Scale 1: 50,000


MOUNT COTTERELL
MOUNT LA FORME
Elm Creek
L 14185
L 14182
L 14192
L 14194
L 14196
L 14193
L 14186
L 14184
L 14183
L 14187
L 14188
L 14189
L 14190
L 14191
L 8575
L 8574
L 8571
L 8572
L 8573
L 8576
L 14863
L 14862
L 14861
L 14860
L 14864
L 14865
L 14859
L 14858
L 14857
L 14856
7000
7500
6300
5000
4500
4000
3500
6500

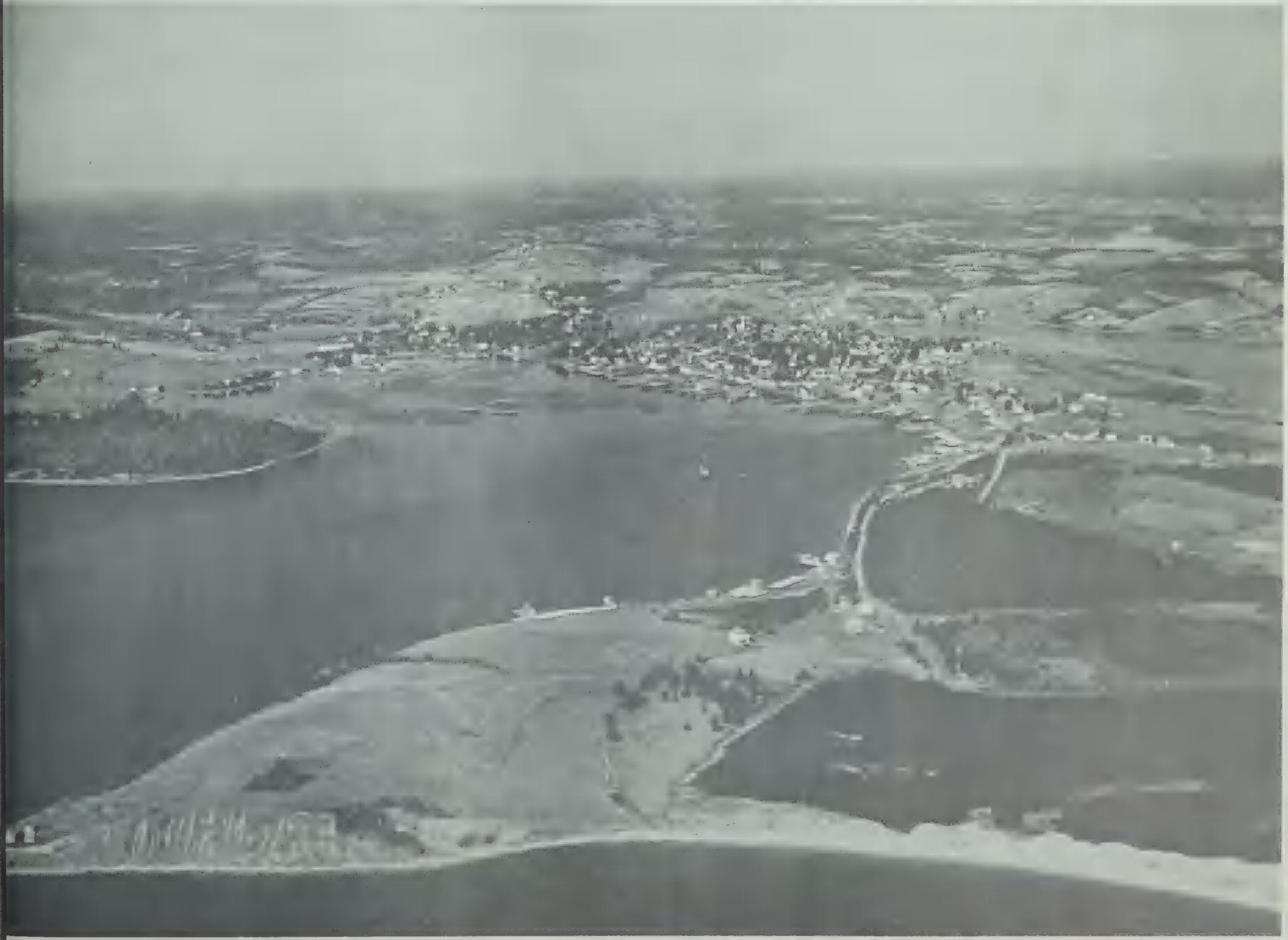
LUNENBURG

Lunenburg is on the east coast of Nova Scotia about 60 miles southwest of Halifax.

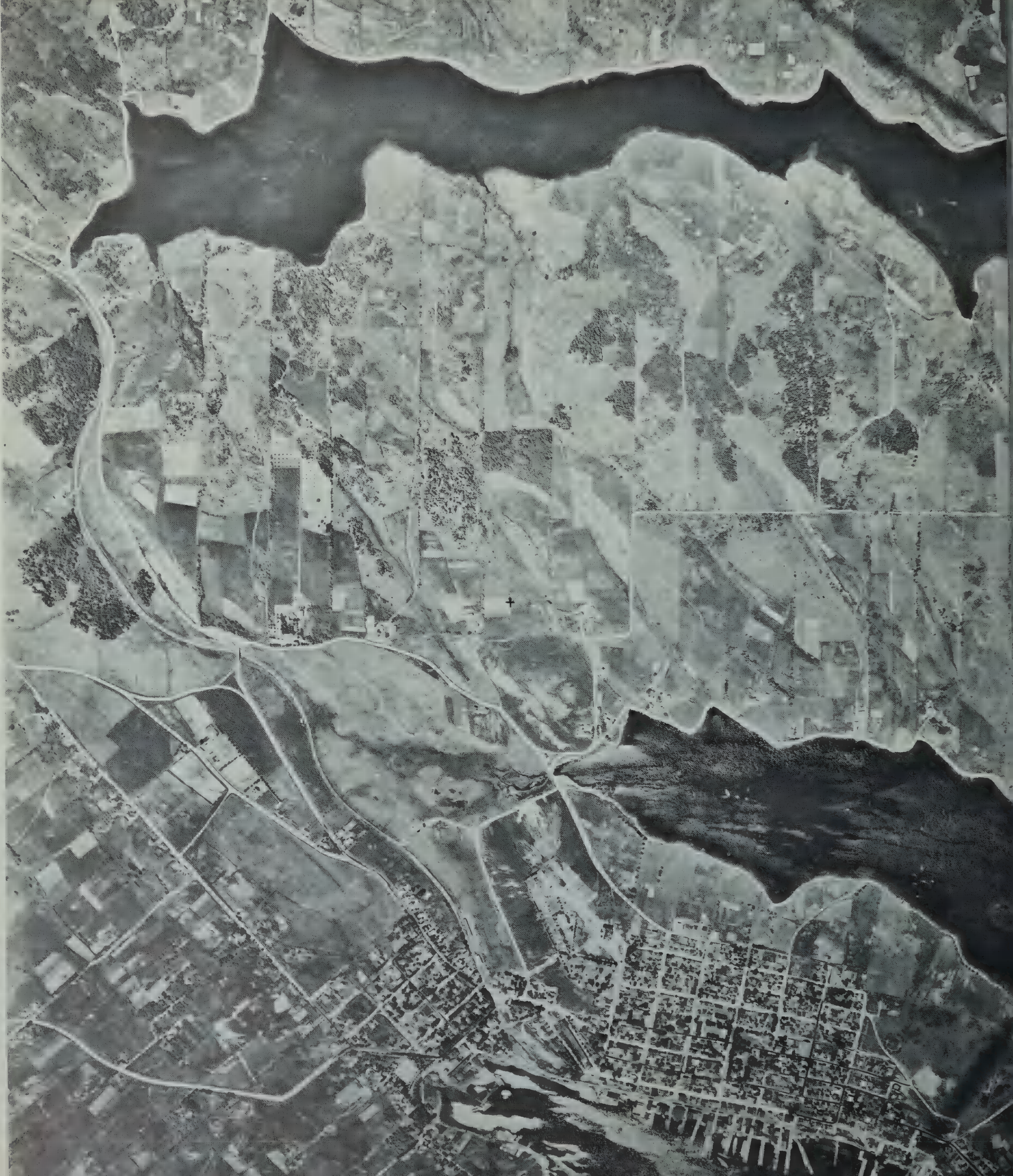
Assignment

1. Using the scale, find the railway distance between Lunenburg and Mahone Bay. What is the true direction of Lunenburg from Mahone Bay?
2. What symbols are used on this map for barns, houses, cliffs, foreshore flats, marshes?
3. What is the difference in elevation between the low point and the high point on the map?
4. (*a*) Study the map and determine the grain of the country, i.e., northwest to southeast, southeast to northwest, etc.
    (*b*) Account for this grain.
    (*c*) From a study of the oblique air photograph, what geographic expression would best describe the topography in the background?

LUNENBURG 1

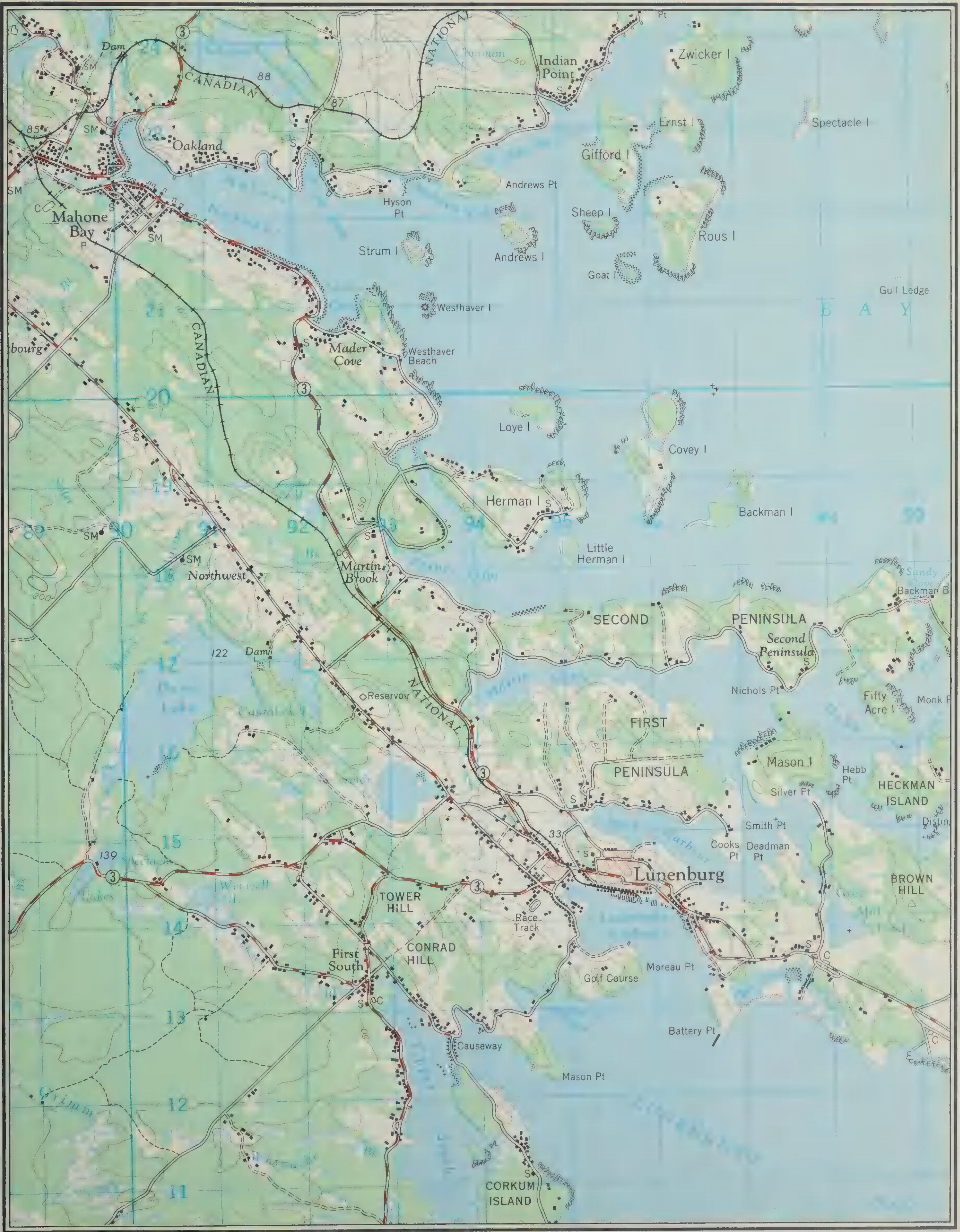


LUNENBURG



LUNENBURG

Scale 1: 50,000


Dam
CANADIAN
NATIONAL
Common
Indian Point
Zwicker I
Ernst I
Spectacle I
Gifford I
Oakland
SM
Mahone Bay
Andrews Pt
Hyson Pt
Sheep I
Rous I
Strum I
Andrews I
Goat I
Gull Ledge
BAY
Westhaver I
Mader Cove
Westhaver Beach
CANADIAN
Loye I
Covey I
Herman I
Backman I
Little Herman I
Martin Brook
Northwest
SECOND
PENINSULA
Second Peninsula
Sandy Cove
Backman B
Dam
Reservoir
NATIONAL
Nichols Pt
Fifty Acre I
Monk P
FIRST
PENINSULA
Mason I
Hebb Pt
Silver Pt
HECKMAN ISLAND
Smith Pt
Cooks Pt
Deadman Pt
Distin
Lunenburg
BROWN HILL
TOWER HILL
Race Track
CONRAD HILL
First South
Golf Course
Moreau Pt
Battery Pt
Causeway
Mason Pt
CORKUM ISLAND
Grimm
3
85
88
87
139
122
33

5. What evidences are there that this area was subjected to glaciation?

6. (*a*) Locate Battery Point and Eel Pond on the oblique air photograph. What geographical terms could be applied to the two features in the immediate foreground of the picture? Account for their existence.

   (*b*) Find examples of baymouth bars and sandspits on the map.

   (*c*) What indications are there that in the past this was a coastline of submergence?

7. (*a*) Estimate the percentage of forested land on the map. Note any associated land use.

   (*b*) Sixty miles north of Lunenburg is the Halifax-Dartmouth urban area containing 200,000 people. How is the proximity of this metropolitan area reflected in the agricultural land use?

   (*c*) Apart from Lunenburg and Mahone Bay, describe the two types of settlement pattern. Try to determine the reasons for each.

8. (*a*) What indications are there on the photographs and map that Lunenburg's economy is based on the sea?

   (*b*) What advantage, as shown on the oblique air photograph and the map, does the site of Lunenburg possess? What disadvantages are apparent in the site of Mahone Bay?

   (c) From a study of the air photographs describe the size and types of vessels shown in Lunenburg harbour.

9. From the map show how the railway and highway network into Lunenburg conforms to the topography of the land.

10. (*a*) Estimate the area in square miles shown on the vertical air photograph.

    (*b*) Identify the bodies of water shown on the vertical and oblique air photographs.

    (*c*) From a study of the map and air photographs, in what part of the First Peninsula is most agriculture concentrated?

    (*d*) Assuming five persons to a dwelling, estimate the population density of the First Peninsula east of Highway 3.

NOOTKA-NANAIMO

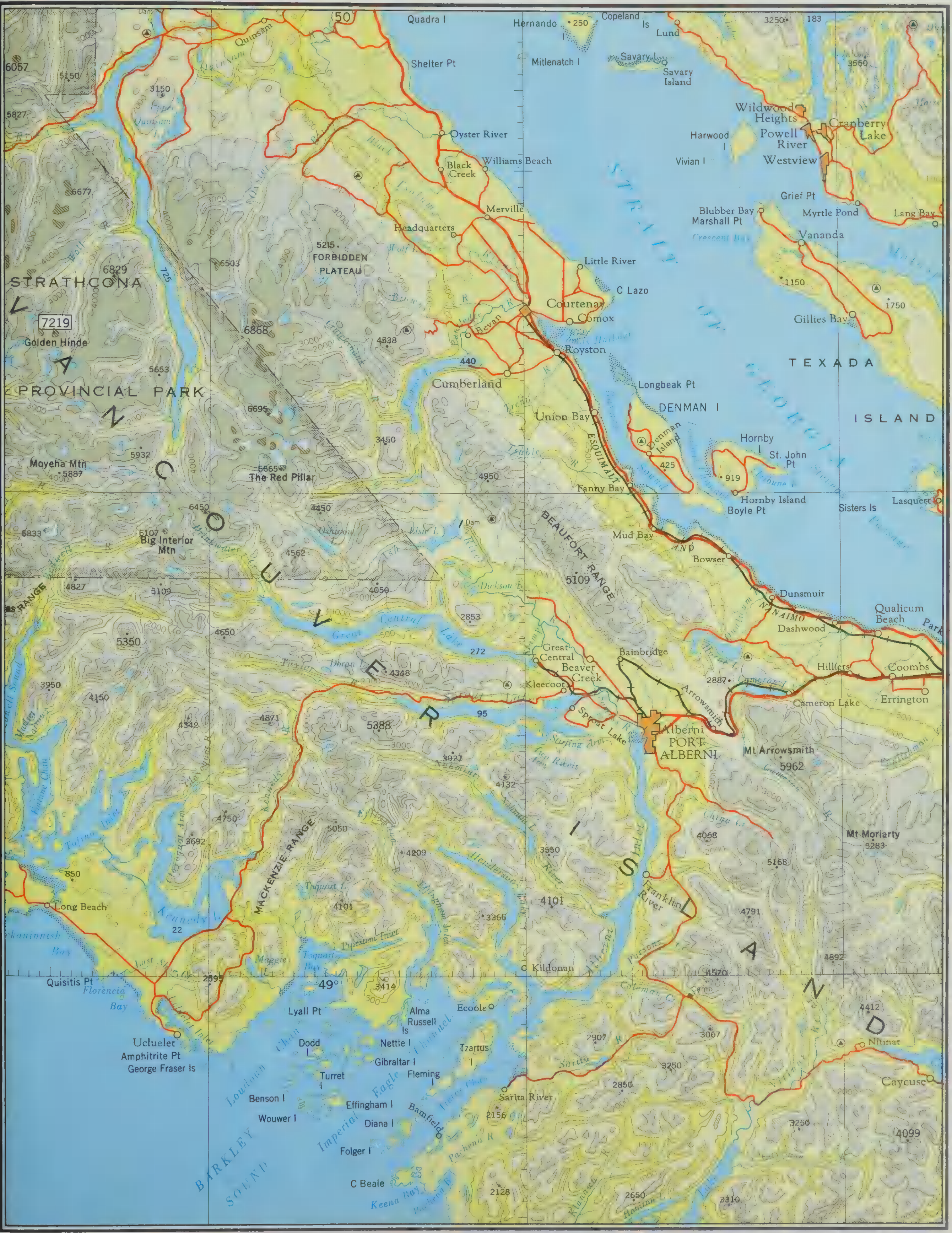
Most of the map shows Vancouver Island on the Pacific coast. This is an extremely complex geological area: it contains part of the Insular Mountains and the Coastal Trench. Most of the latter is submerged under Georgia Strait and other coastal waters not shown on the map.

Assignment

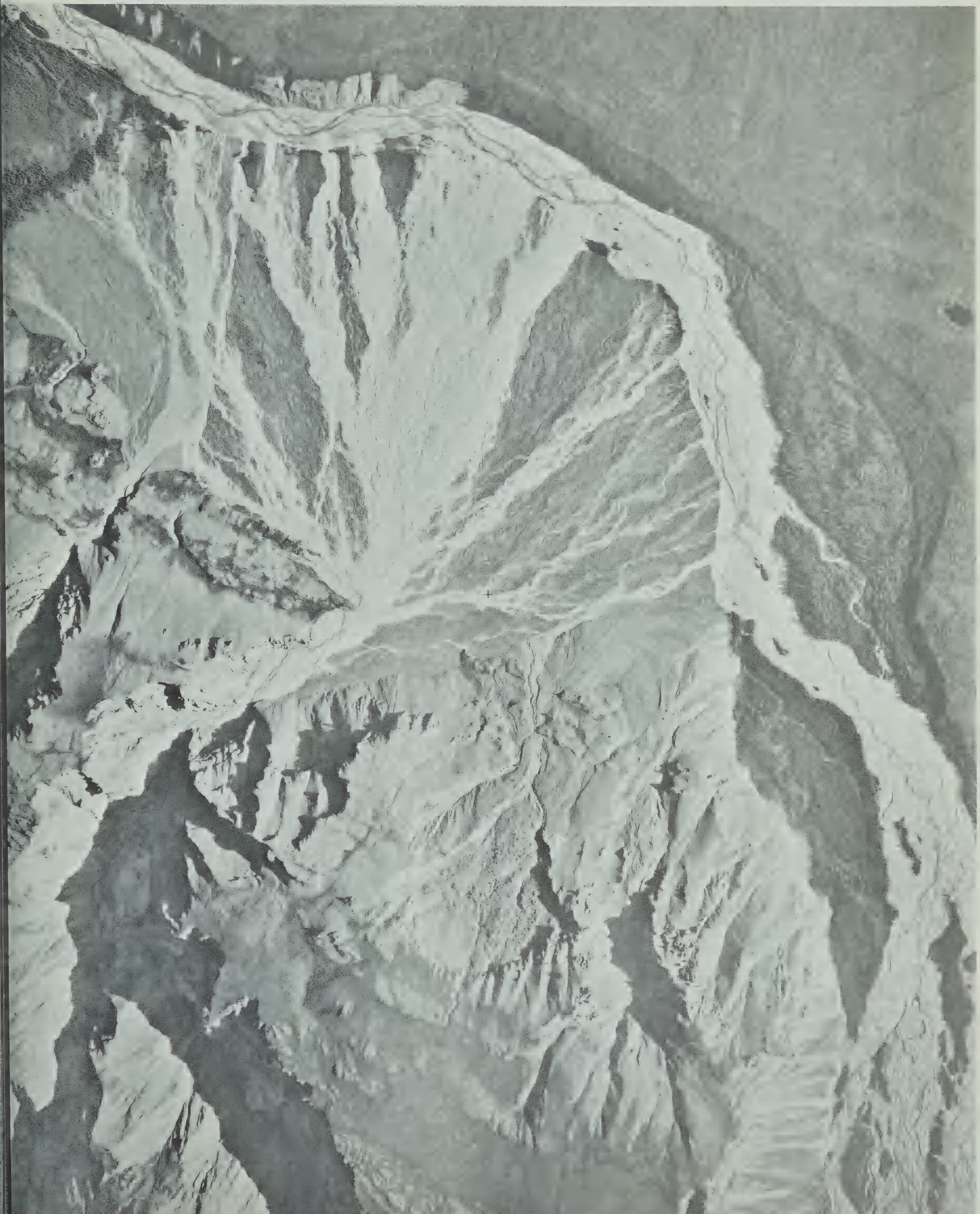
1. What is the range of relief shown on the map?
2. (*a*) Define nautical mile.
   (*b*) What is the width in miles (both nautical and statute) of Vancouver Island at the widest part shown?
   (*c*) How far in statue miles is Port Alberni from (i) the open sea at Cape Beale? (ii) Dunsmuir on the Strait of Georgia? (iii) What is the average width of Alberni Inlet?
3. (*a*) Draw a sketch profile from Turret Island on the west coast to Mud Bay on the east coast. In this type of profile it is not necessary to include every single contour. Take into consideration primarily only the highest and lowest elevations in each subregion. What type of mountain system is depicted by this profile?
   (*b*) Draw two sketch profiles through Golden Hinde Mountain. The east-west profile should be drawn north-west from point 5653 through the summit of the Golden Hinde Mountain to the edge of the map. The north-south profile should be from 6677 on the north to 5887 on the south. Assume both profiles to pass through Golden Hinde.
      (i) Study these profiles and determine the physical feature they represent.
      (ii) How would you describe the type of drainage pattern around Golden Hinde?
      (iii) How was the feature noted in part (i) created?
4. (*a*) Write descriptive notes on the physical features of the two coastlines.
   (*b*) There is obviously a marked contrast between the two coasts. What terms would best describe each?
   (*c*) What evidence on the map would suggest that this area has been exposed to glaciation?
   (*d*) How did the glaciation influence the siting of and the economy of Port Alberni?
5. (*a*) Find the area shown on this map in an atlas. In what latitude does it lie? At this latitude what would the prevailing air masses be?
   (*b*) Refer to the sketch profile drawn in question 3 (*a*) and describe the distribution of precipitation over the map area. What effect would these air masses have on temperatures?
   (*c*) Which side of the island would have the greater risk of forest fire? Why?
   (*d*) What form of natural vegetation would be most abundant as a result of this climate?
   (*e*) In what respects does land use north and east of a line from Forbidden Plateau to Mount Moriarty differ from land use to the south and west?
6. Show how transportation tends to conform to physiographic features by describing the route followed by the road from Port Alberni to Long Beach on Tofino Inlet on the Pacific Coast.
7. (*a*) What were the considerations in the siting of Port Alberni? Why would it be difficult to locate a settlement elsewhere on Alberni Inlet? Explain why Port Alberni was located on the east side of the Inlet rather than the north side. What does this consideration tell you about the possible function of Port Alberni?
   (*b*) Why would the largest concentration of population west of the Beaufort Range be in the Port Alberni area?
   (*c*) Suggest the two most likely dominant occupations for Port Alberni. Why is this city ideally suited for each?

NOOTKA-NANAIMO

Scale 1: 500,000

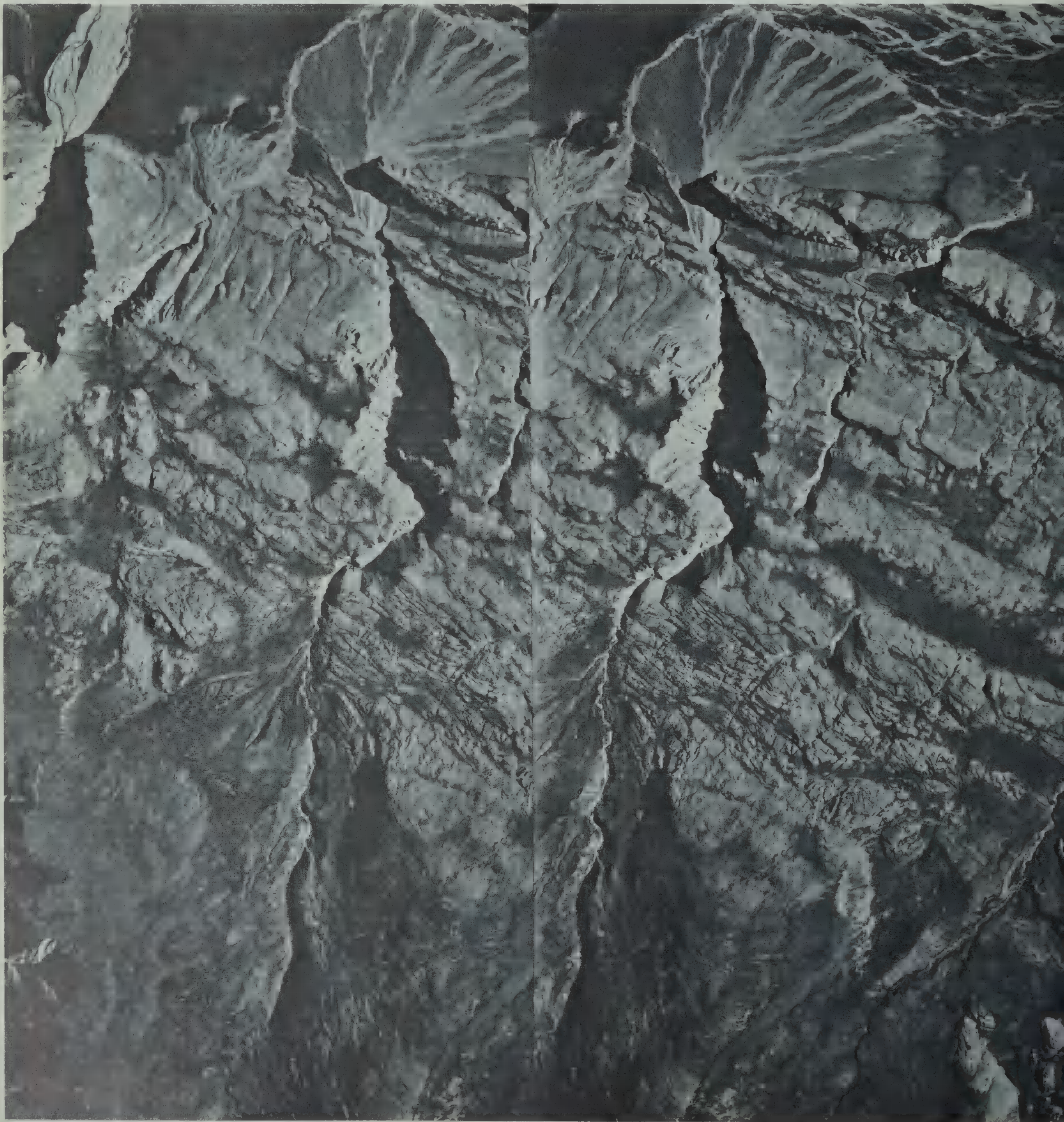

Quadra I
Hernando I
250
Copeland Is
Lund
3250
183
Quinsam
50
Shelter Pt
Mitlenatch I
Savary I
Savary Island
3550
6057
5150
3150
5827
Wildwood Heights
Cranberry Lake
Powell River
Westview
Harwood I
Vivian I
Oyster River
Williams Beach
Black Creek
Merville
Headquarters
Grief Pt
Blubber Bay
Marshall Pt
Myrtle Pond
Lang Bay
Vananda
Crescent Bay
6677
5215
FORBIDDEN PLATEAU
6503
Little River
C Lazo
1150
1750
6829
STRATHCONA
725
7219
Golden Hinde
6868
Courtenay
Comox
Bevan
Gillies Bay
4538
Royston
440
TEXADA
Cumberland
Longbeak Pt
5653
PROVINCIAL PARK
DENMAN I
6695
Union Bay
ISLAND
Denman Island
Hornby I
St. John Pt
3450
425
919
5932
Moyeha Mtn
5887
6665
The Red Pillar
4950
Fanny Bay
ESQUIMALT
Hornby Island
Boyle Pt
Sisters Is
Lasqueti
6450
4450
BEAUFORT RANGE
Mud Bay
AND
6833
6107
Big Interior Mtn
4562
Bowser
RANGE
4827
5109
4050
5109
Dunsmuir
NANAIMO
Qualicum Beach
Dashwood
2853
Central Lake
Great Central
Beaver Creek
Bainbridge
5350
4650
272
3950
4150
4348
Kleecoot
2887
Hilliers
Coombs
Cameron Lake
Errington
95
Sproat Lake
Arrowsmith
4871
4342
5388
Alberni
PORT ALBERNI
Mt Arrowsmith
5962
3927
4132
4750
3692
5050
MACKENZIE RANGE
4209
3550
4068
Mt Moriarty
5283
5168
850
Long Beach
4101
Kennedy L
22
3366
4101
Franklin River
4791
Kildonan
4892
Quisitis Pt
Florencia Bay
2595
49°
3414
4570
Lyall Pt
Alma Russell Is
Ecoole
4412
Ucluelet
Amphitrite Pt
George Fraser Is
Dodd I
Nettle I
Gibraltar I
Tzartus I
2907
3067
Nitinat
Turret I
Fleming I
3250
Benson I
Wouwer I
Effingham I
Diana I
Sarita River
2850
Caycuse
Bamfield
2156
3250
4099
Folger I
C Beale
BARKLEY SOUND
Keena Bay
2128
2650
3310
VANCOUVER ISLAND
STRAIT OF GEORGIA

LORETTA CANYON 1



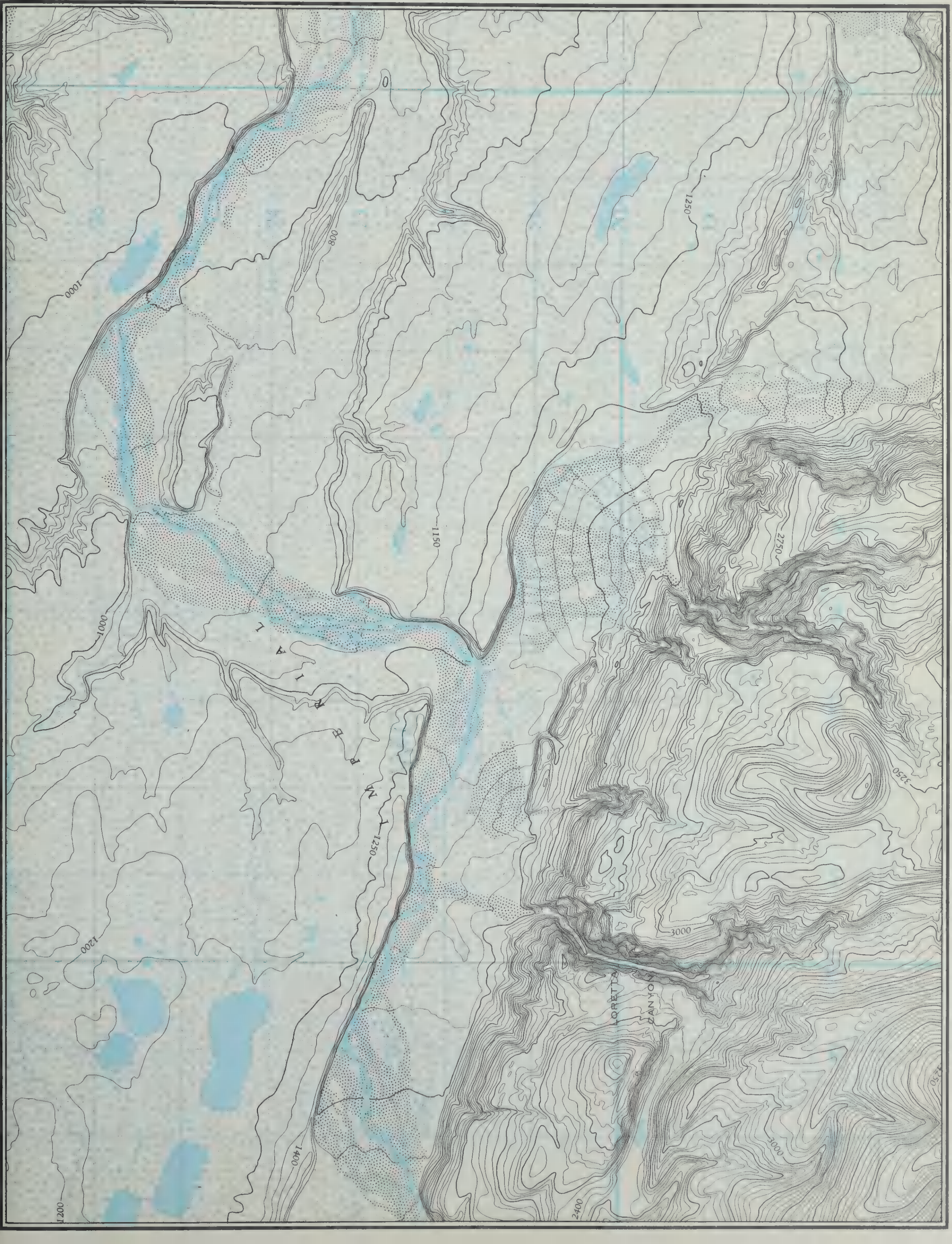
Loretta Canyon is in the Northwest Territories midway between Great Slave Lake and the mouth of the Mackenzie River. The area shown is approximately 65°N Latitude and 127°W Longitude. The main river shown is the Imperial River, a tributary of the Carcajou which in turn joins the Mackenzie River about ten miles northeast of this map. The mountain complex of which Loretta Canyon is a part is called the Carcajou Mountains.

LORETTA CANYON 2



LORETTA CANYON ←

Scale 1: 50,000


1000
800
1250
1150
IMPERIAL
2750
3250
1000
1250
3000
LORETTA CANYON
1200
450
1400
3000
1200
2400

Assignment

1. What is the contour interval?
2. Draw two profiles from the R in Loretta — one due east for one mile and one due north for two miles. Use only the dark 250′ contour lines and use a vertical scale of $\frac{1}{4}''$ to 250′. Label the main features shown on the profiles.
3. (*a*) What feature marks the junction between two geological series? Account for it. Find this feature on Photograph 1.
   (*b*) How does the pattern of relief suggest that folding occurred in the area?
4. (*a*) In what direction is the Imperial River flowing? Justify your answer.
   (*b*) Is there any indication from the stereo photograph and the map that the rivers in the mountains are flowing over soft sedimentary rocks? What feature results? Give the greatest depth of this feature.
   (*c*) Name the feature where the rivers emerge from the mountains as shown on the map, stereo, and Photograph 1. How is this feature created?
   (*d*) What geographical term is used to describe a stream such as the Imperial River? Study the map and Photograph 1. Why does a river develop such an appearance?
   (*e*) Explain the presence of a high bluff on the north bank of the Imperial River as seen on the photographs and the map. How high is the bluff shown on Photograph 1?
5. (*a*) Locate a dry valley on the map. What might this indicate?
   (*b*) From a study of the contour lines on the Imperial River, is there anything that suggests a reversal of flow may have occurred?
6. (*a*) Where does most tree growth occur on the map and Photograph 1? Why?
   (*b*) Find the upper limit (tree line) in the mountain area.
   (*c*) Suggest several reasons why the exploitation of forests in this area would be difficult.

PEACE RIVER

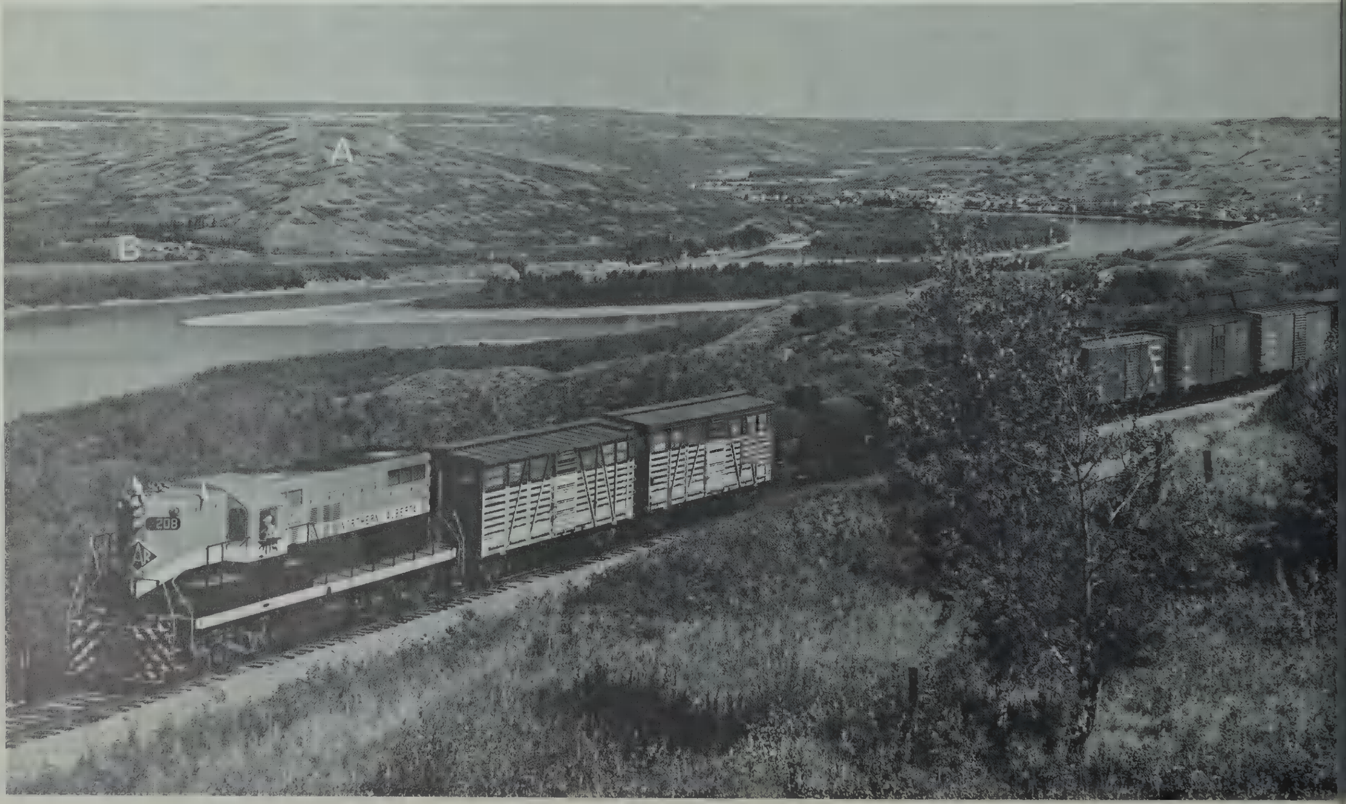
The region shown is in northwestern Alberta, about 100 miles east of the Alberta-British Columbia boundary. The large tributary of the Peace River shown on the sheet is the Smoky River. The build is very simple, consisting of almost level beds of Cretaceous rocks which are in places almost 5,000 ft. thick; and as such this area is a continuation of the Interior Lowlands and Plains.

The Peace River flows northward and becomes a tributary of the Slave River in northeastern Alberta.

Assignment

1. (*a*) Draw a section or profile from grid reference 750300 to grid reference 820210. Use a vertical scale of $\frac{1}{8}$ in. to 50 ft.
   (*b*) In two words describe the general topography of the area shown on the profile.
2. (*a*) Find the difference in elevation between bench mark 1847 near Judah and the river level itself.
   (*b*) What type of valley has the Smoky River cut? What does this tell you about the material over which it passes?
   (*c*) Account for the considerable deposition that has occurred in both the Peace and Smoky Rivers as shown on map and photographs.
   (*d*) Considering the type of valley both the Smoky and Peace Rivers have cut, suggest a possible development along each. Why are such valleys well suited to such developments?
3. (*a*) In what way are the Peace and Smoky Rivers different from most other rivers on the map?
   (*b*) Why are they different?
   (*c*) What does the nature of the smaller rivers indicate about the climate of the area?
   (*d*) Why despite this type of climate is there so much forest cover?
4. (*a*) Locate on the map the easterly tributary stream that crosses Lot 25. Find this same stream on Photograph 2. Describe the drainage basin of this stream. What type of erosion is evident in this area? Account for the amount of vegetative cover.
   (*b*) Construct a profile of this tributary from its point of origin to its mouth, and determine through how many feet it drops.

PEACE RIVER 1



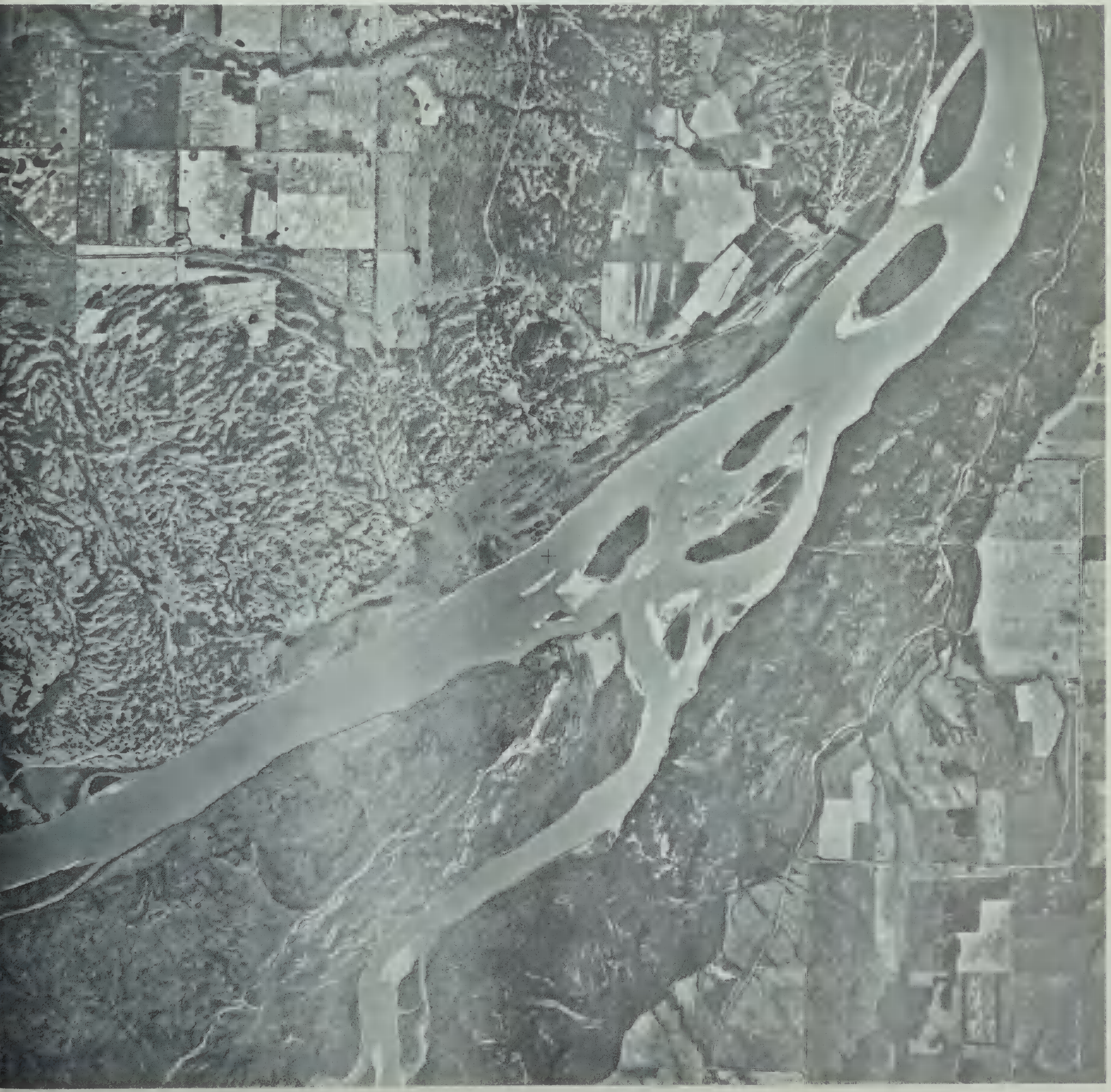
5. (*a*) Why is the Shaftesbury Settlement only located on the north bank of the Peace River? Find the Settlement on Photograph 2.
   (*b*) Estimate the size of Lot 30. Study Photograph 1 and the physical feature lettered A. Find this feature on the map. Locate on the map the lot lettered B on Photograph 1.
   (*c*) Study the lots in the Shaftesbury Settlement. Why do many of these have no home or farm buildings? Study Photograph 2 and the map and explain why Lot 25 is more developed than Lot 27.
   (*d*) How far is it from the house on Lot 30 to the house on Lot 33?

Where are there farm dwellings outside the Shaftesbury Settlement? Suggest reasons why farming spread from the Shaftesbury Settlement to these areas. Describe the type of settlement pattern that has emerged.

(*b*) Compare and contrast the settlement pattern along the Peace River with that downstream from Montreal.

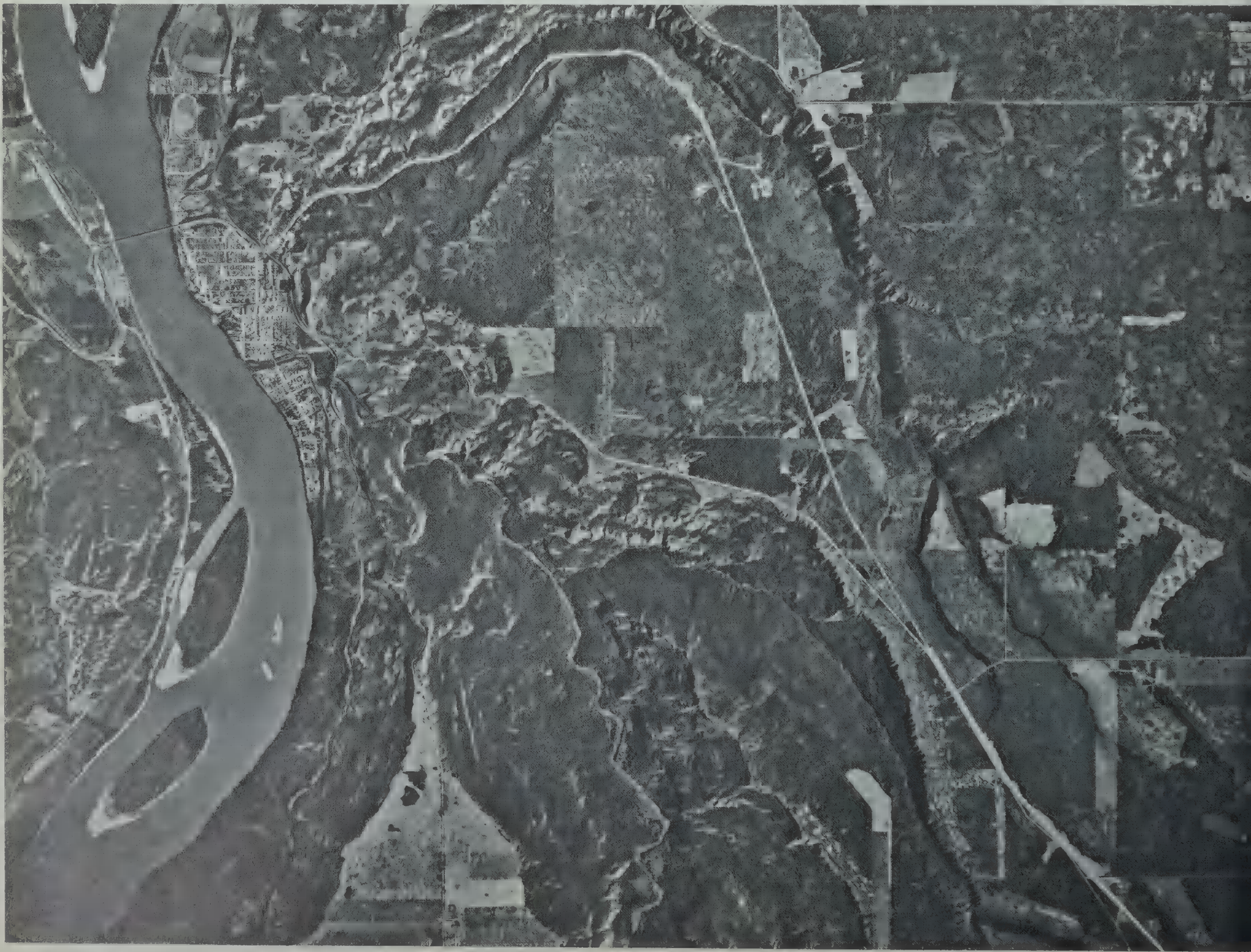
(*c*) What factors on the map and photographs suggest the type of farming practised?

PEACE RIVER 2



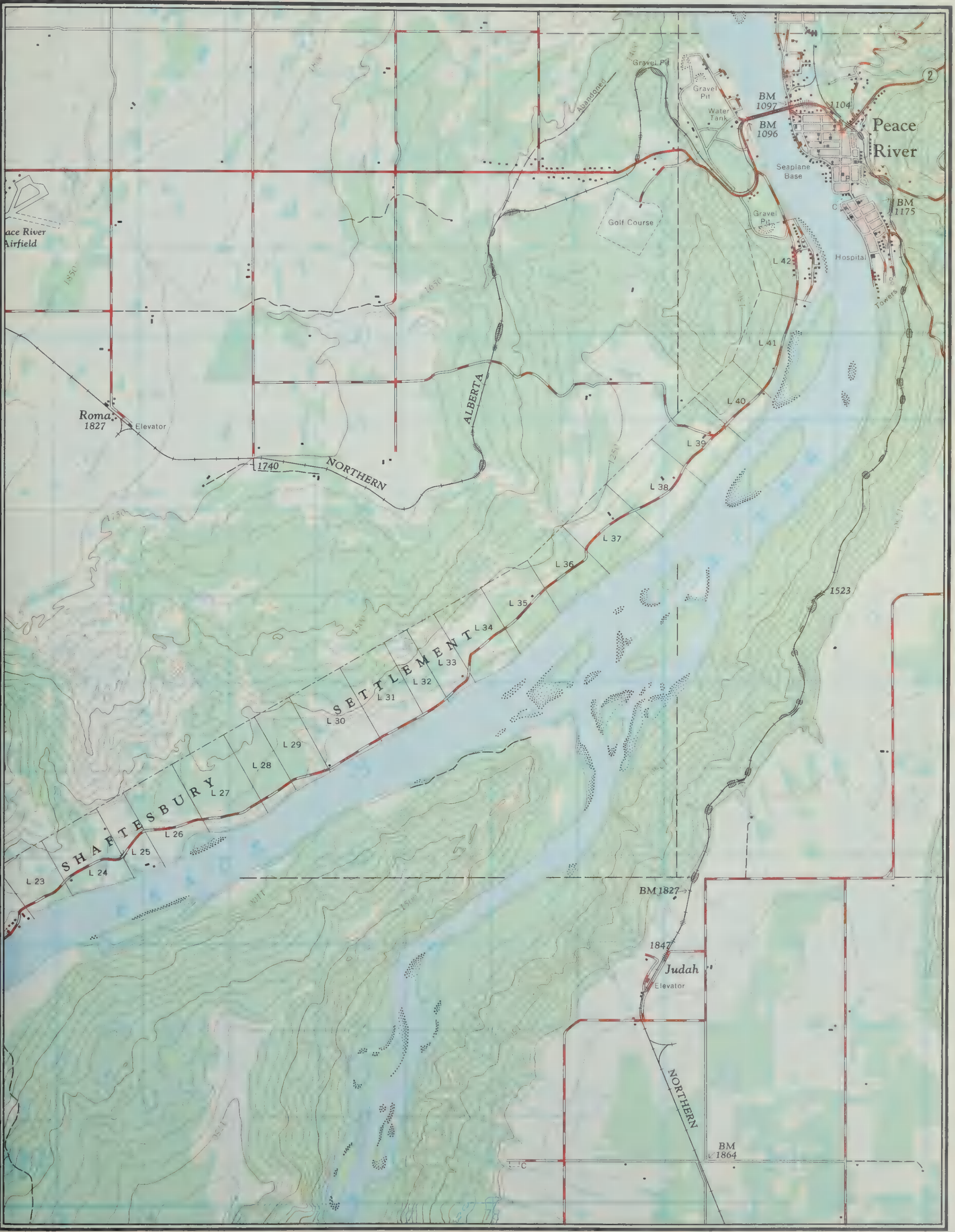
7. (*a*) Study the site of the town of Peace River, on the map and Photograph 3. What advantages were offered by this particular site?
   (*b*) Despite these advantages, what obvious transportation problems exist? Study Photographs 1 and 3 as well as the map.
   (*c*) Describe, in a brief note, the problems encountered by the Northern Alberta Railway between Judah and Peace River. Refer to Photographs 2 and 3 as well as the map.
   (*d*) Describe and account for the differences in the road pattern found on the plateau in the northwest and the road pattern found in the area around Peace River and the Shaftesbury Settlement. Note in particular the loose-surface, all-weather road entering Peace River from the north and east.

PEACE RIVER 3



PEACE RIVER

Scale 1: 50,000


Peace River
Peace River Airfield
Gravel Pit
Gravel Pit
Water Tank
BM 1097
BM 1096
1104
Seaplane Base
Golf Course
Gravel Pit
BM 1175
Hospital
Towers
Abandoned
2
L 42
L 41
L 40
L 39
L 38
L 37
L 36
L 35
L 34
L 33
L 32
L 31
L 30
L 29
L 28
L 27
L 26
L 25
L 24
L 23
SHAFTESBURY SETTLEMENT
Roma
1827
Elevator
1740
ALBERTA
NORTHERN
1850
1650
1750
1250
1500
1523
BM 1827
1847
Judah
Elevator
NORTHERN
BM 1864
C

MEDICINE HAT

This area is located in the southeastern part of Alberta just north of the Cypress Hills. The city of Medicine Hat is on the South Saskatchewan River.

Assignment

1. (*a*) In which direction is the river flowing? How do you know?
   (*b*) In which direction was Photograph 1 taken? Locate on the map the two bluffs in the right foreground of the photograph. How high is the one south of the river? With reference to the map and Photograph 1, how is the bluff broken? How is this break used? What term could be used to describe the land between the two bluffs?
   (*c*) Account for the deeply entrenched nature of the meanders on the South Saskatchewan River.
   (*d*) Account for the gentler slope of the land on the inside bend of the meander and the steep slope on the outside bend. What feature is indicated by the light-coloured areas on the inside of the meander on Photograph 2?

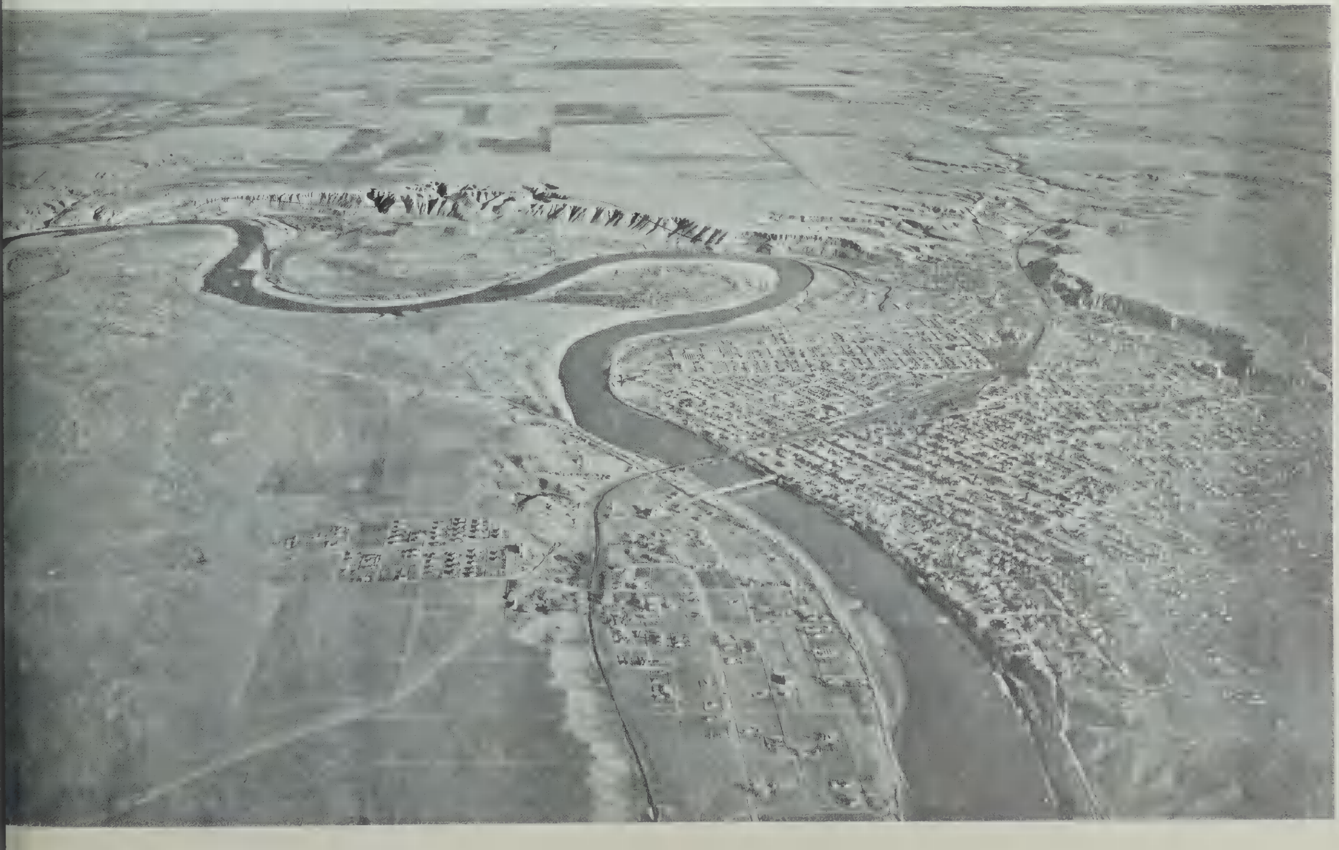
2. (*a*) Which is the greater, vertical or lateral erosion on the tributary creeks? Why? Study Photographs 1 and 3 as well as the map.
   (*b*) Classify the climate of this area as humid or arid. Give three reasons for your choice.
   (*c*) What type of relief has resulted from the climate and the tributary erosion?

3. Find two areas of dense natural vegetation and account for their location.

4. What does the presence of large greenhouses indicate about climatic conditions? Locate one set of greenhouses on Photograph 2.

5. (*a*) Considering parent material, vegetation and climate, what soil type would be most common away from the river valley?
   (*b*) Considering the above factors, what serious farming problems exist?
   (*c*) As a result of these problems, what farming practices have been employed? Refer to air photographs as well as the map.

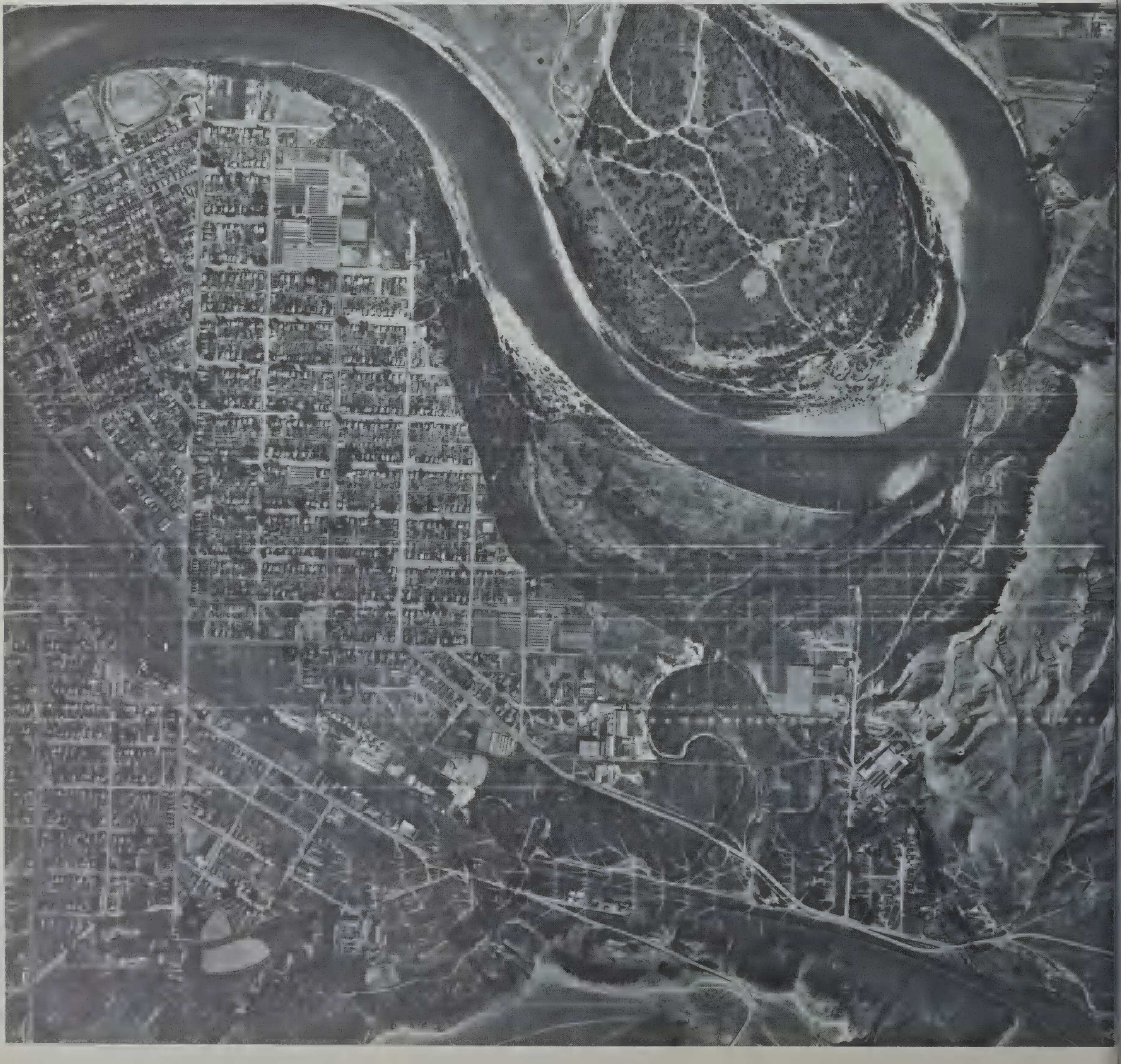
MEDICINE HAT 1



6. (*a*) Draw a profile or cross section from Bench mark 2236 due south across Medicine Hat to the edge of the map. Use a vertical scale of $\frac{1}{8}$" to 50′.
   (*b*) From your cross section and a study of the map and Photographs 1 and 2, suggest reasons for the choice of this site for the city.
   (*c*) Describe those factors evident on the map and Photographs 1 and 2 that are making the expansion of the city difficult. Suggest areas in which expansion is possible.
   (*d*) Compare the map and Photograph 1. Which is the more recent?

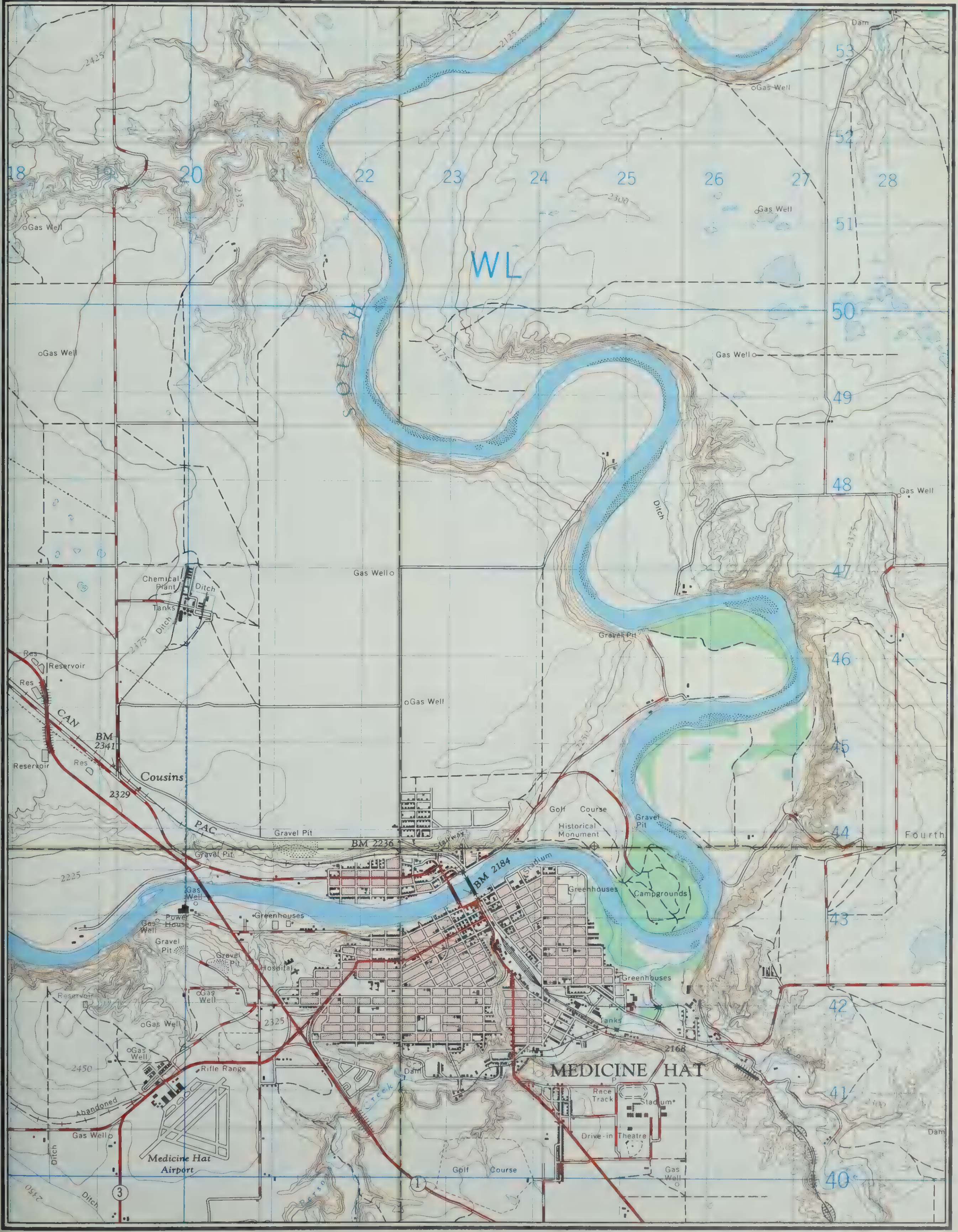
7. (*a*) What does the presence of natural gas deposits indicate about the geological history of the area?
   (*b*) From a study of the map and air photos, what do you consider to be the chief functions of the Medicine Hat district? Where is the chemical plant with reference to the city? Suggest a reason for this location.
   (*c*) From a study of the map, what recreational facilities are available in and around the city?
   (*d*) Find the two bridges on Photograph 1 and on the map. Which is the railway and which is the highway bridge?

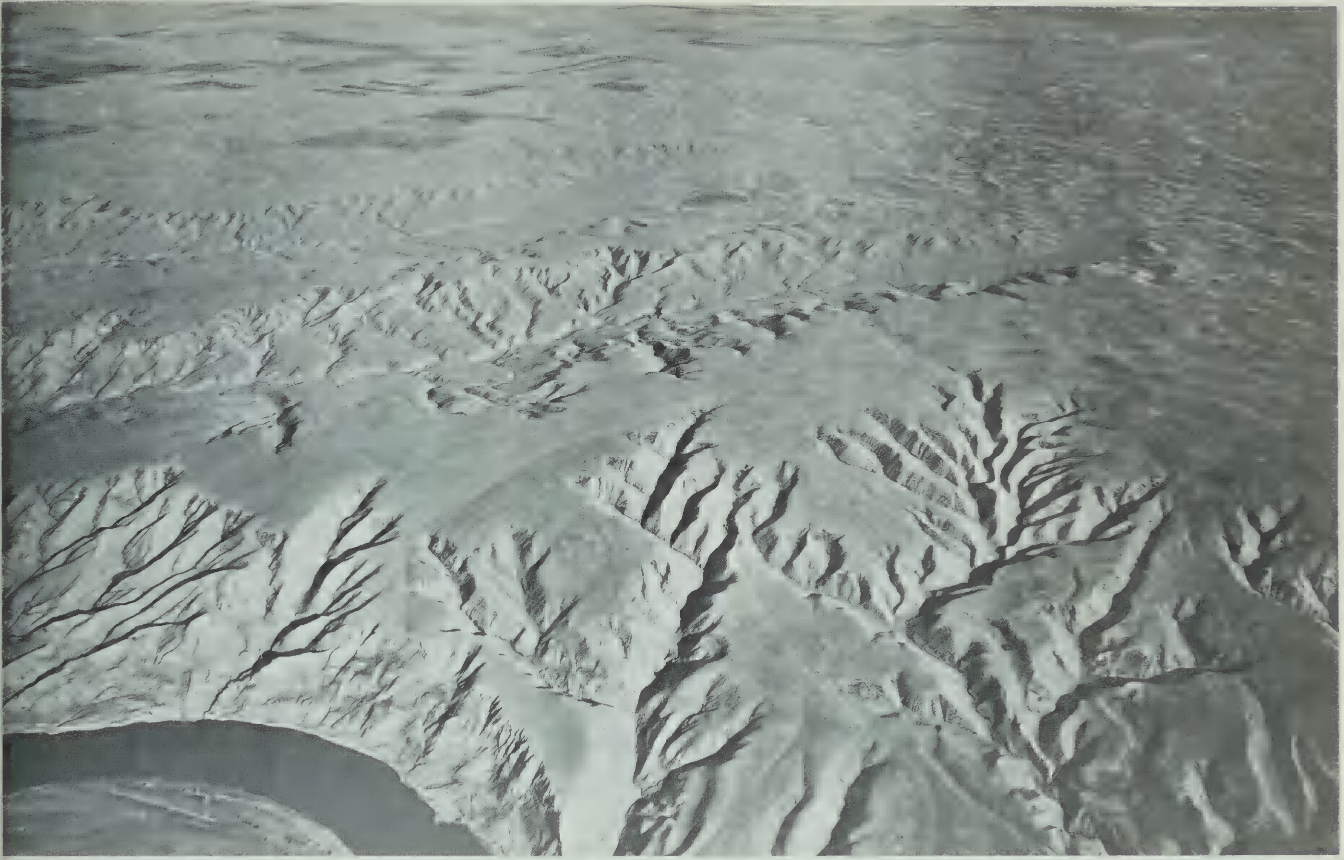
MEDICINE HAT 2



MEDICINE HAT

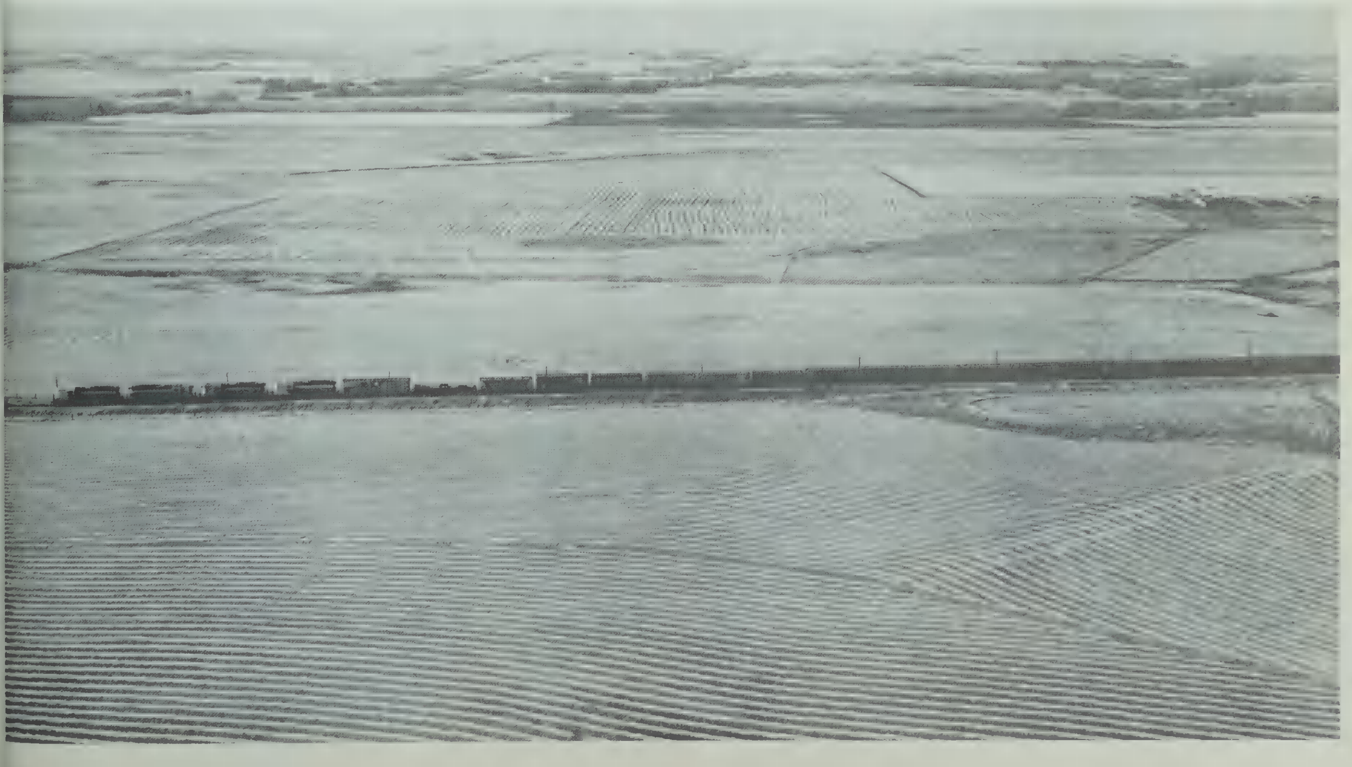
Scale 1: 50,000


South
Saskatchewan
WL
MEDICINE HAT
Medicine Hat Airport
Cousins
CAN
PAC
Chemical Plant
Ditch
Tanks
Reservoir
Res
BM 2341
2329
BM 2236
BM 2184
2168
2225
2325
2450
2425
2375
2300
2125
2175
2251
Gravel Pit
Gas Well
Power House
Greenhouses
Hospital
Rifle Range
Abandoned
Golf Course
Historical Monument
Campgrounds
Stadium
Race Track
Drive-in Theatre
Dam
Parkway
Creek
Seven Persons
Fourth
1
3
18
19
20
21
22
23
24
25
26
27
28
40
41
42
43
44
45
46
47
48
49
50
51
52
53



MEDICINE HAT 3

MEDICINE HAT 4



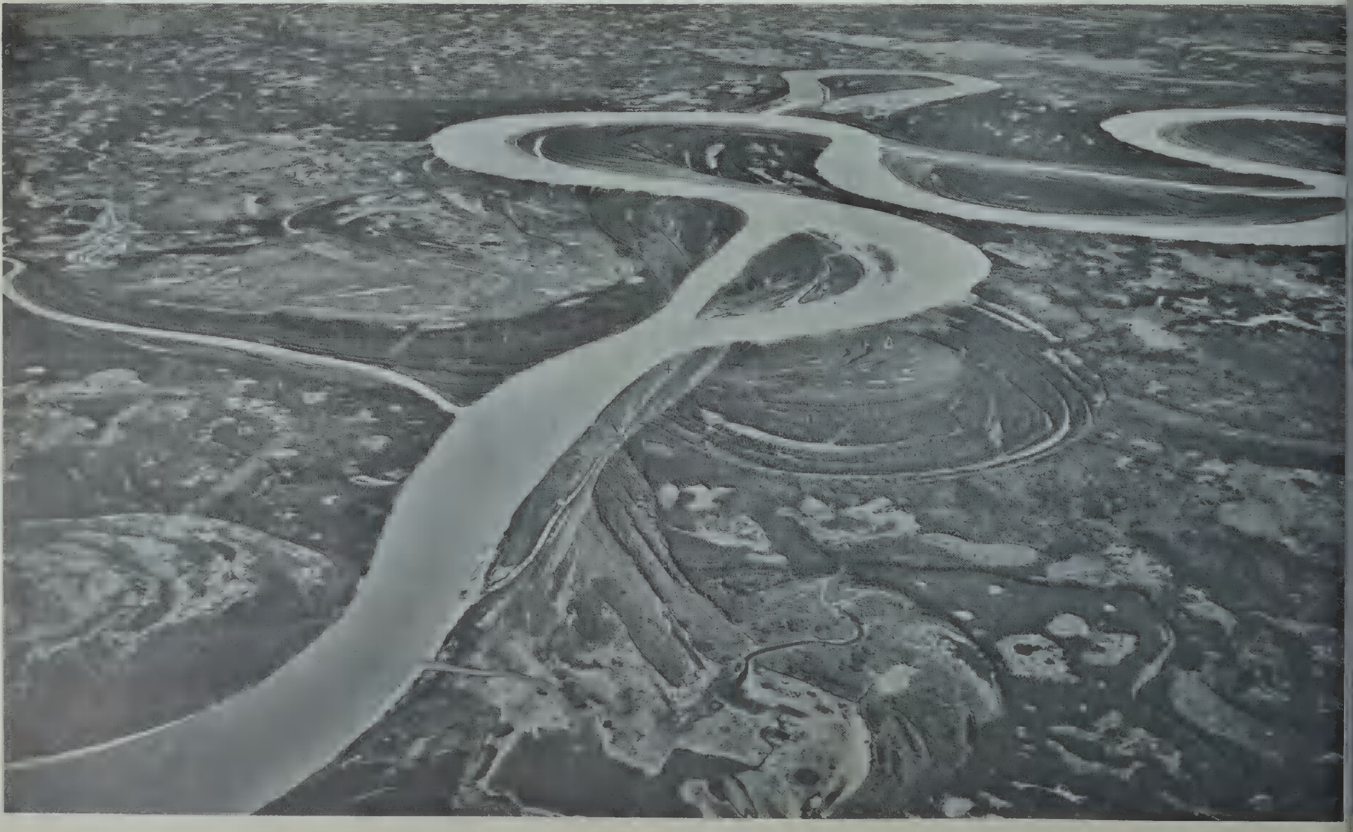
FORT RESOLUTION

This map shows an area in the Northwest Territories, at the mouth of the Slave River where it empties into Great Slave Lake at an elevation of 513 feet. The map represents an area of low relief which has two distinctive features: the flood plain and delta of the Slave River, and the junction of the Canadian Shield with more recent sediments.

Assignment

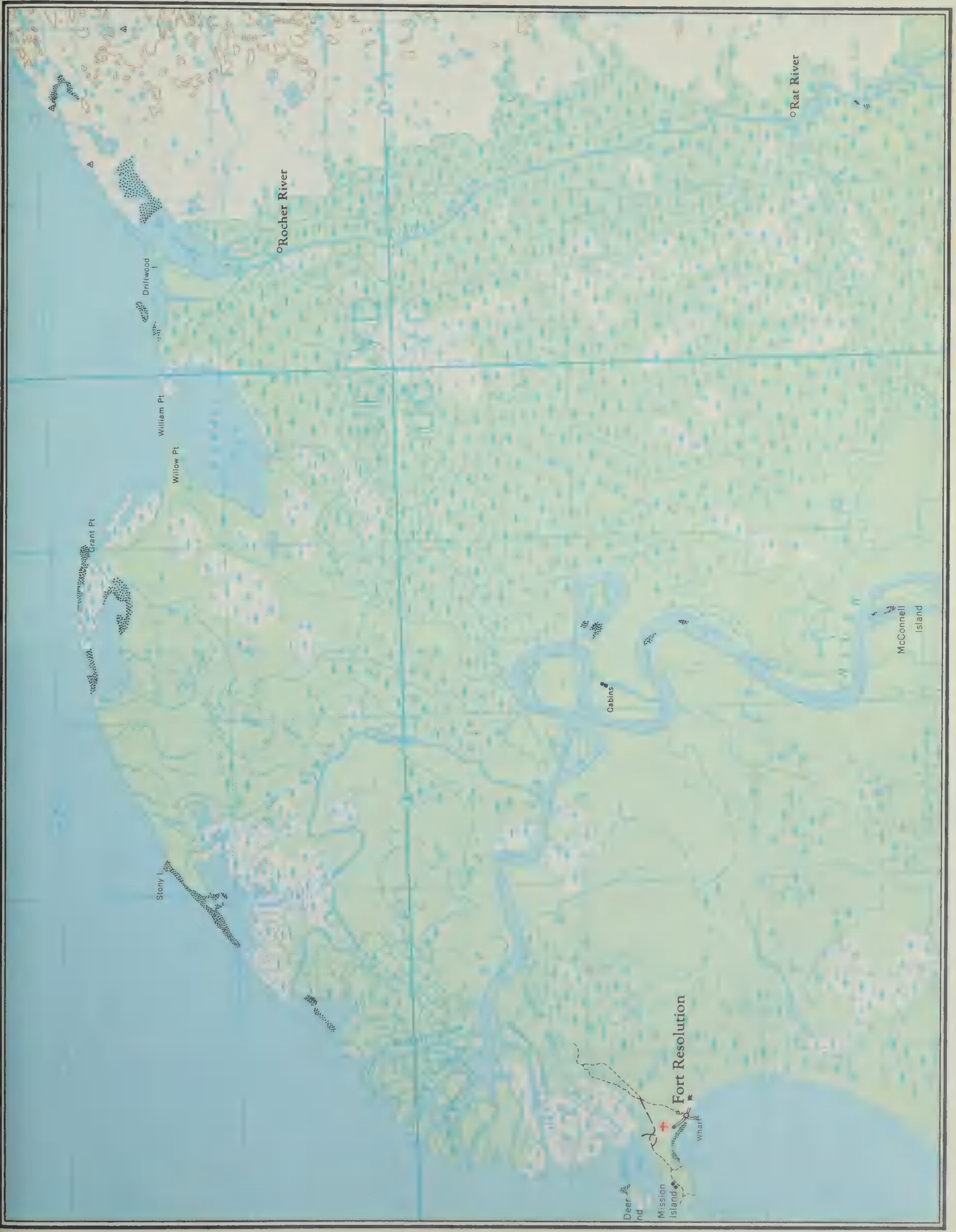
1. Calculate the area shown on the map in square miles.
2. Study the appearance of the Slave River on both map and photographs and classify it as young, mature, old. What features along the course of the river support your answer? What feature is visible on Photograph 1, but not on the map?
3. (*a*) Compare the course of the Slave River to that of the Battle River on the Rosyth sheet. What similarities exist? What is the essential difference between the two rivers and their valleys?
   (*b*) Study the course of the Rat River. What does it tell you about the surface of this region?
4. (*a*) What feature is found at the mouth of the Slave River? Classify it, and describe its physical characteristics through study of Photograph 2 and the map.

FORT RESOLUTION 1



FORT RESOLUTION ←

Scale 1: 250,000 C.I. 100′


Rat River
Rocher River
Driftwood I
William Pt
Willow Pt
Grant Pt
McConnell Island
Cabins
Stony I
Fort Resolution
Wharf
Mission Island
Deer
nd

(*b*) Account for the large number of channels or distributaries found near the mouth. How are some of these used? What does this tell about the use of the Slave River?

5. Why is Fort Resolution situated south rather than north of the mouth of the Slave River?

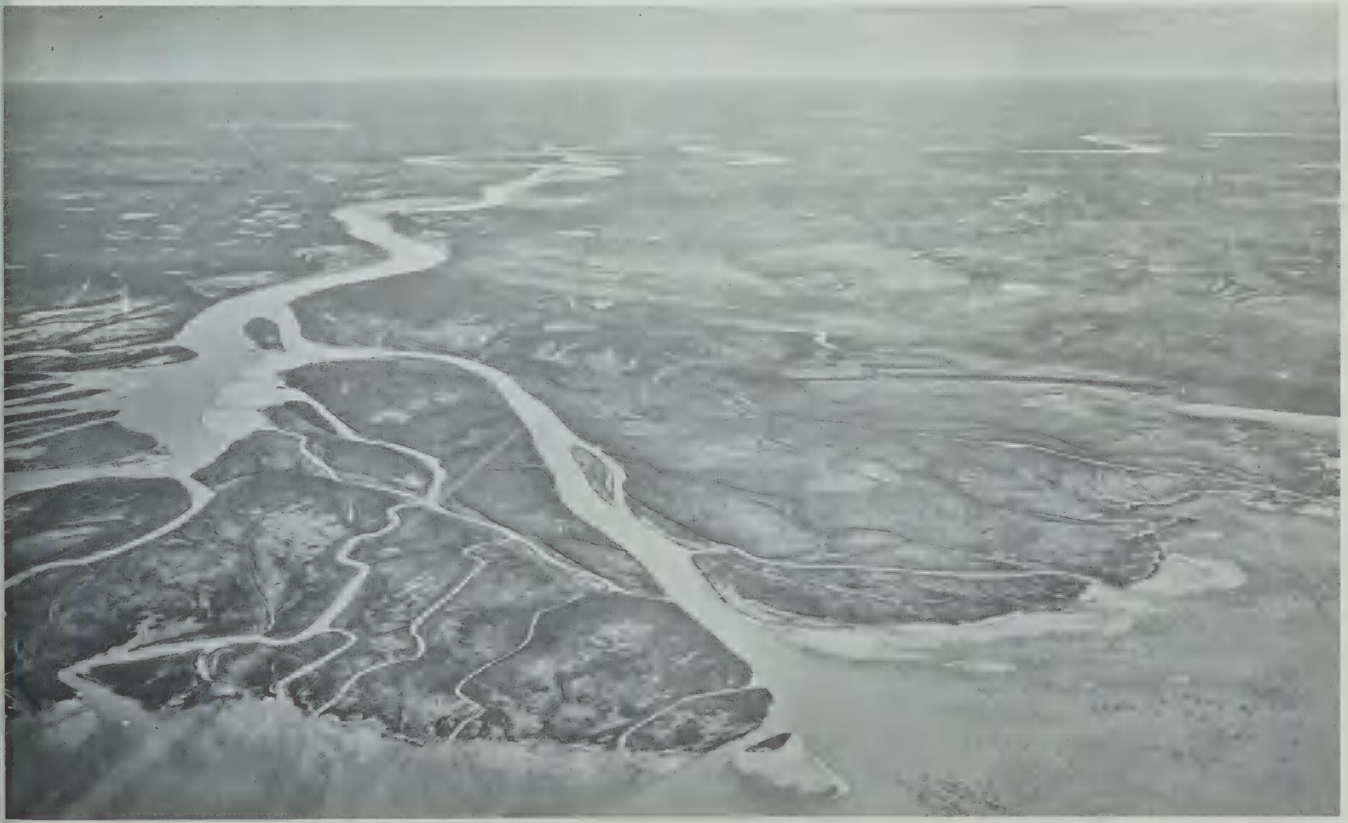
6. Compare the coastline east and west of Taltson Bay and account for any differences.

7. (*a*) Locate on the map the point of contact between the Canadian Shield and the area of more recent deposits. Compare surface features in each part and account for any differences.
   (*b*) Explain the presence of Oracha Falls on the Taltson River.

8. Study the map and determine at least four possible land uses.

9. (*a*) Are the two photographs looking upriver or downriver?
   (*b*) Which photograph shows a larger area of the Slave River valley? Suggest one reason for the difference.
   (*c*) Name the oxbow shown on Photograph 1.
   (*d*) On Photograph 1 how can you tell the difference between swamp and forest vegetation?

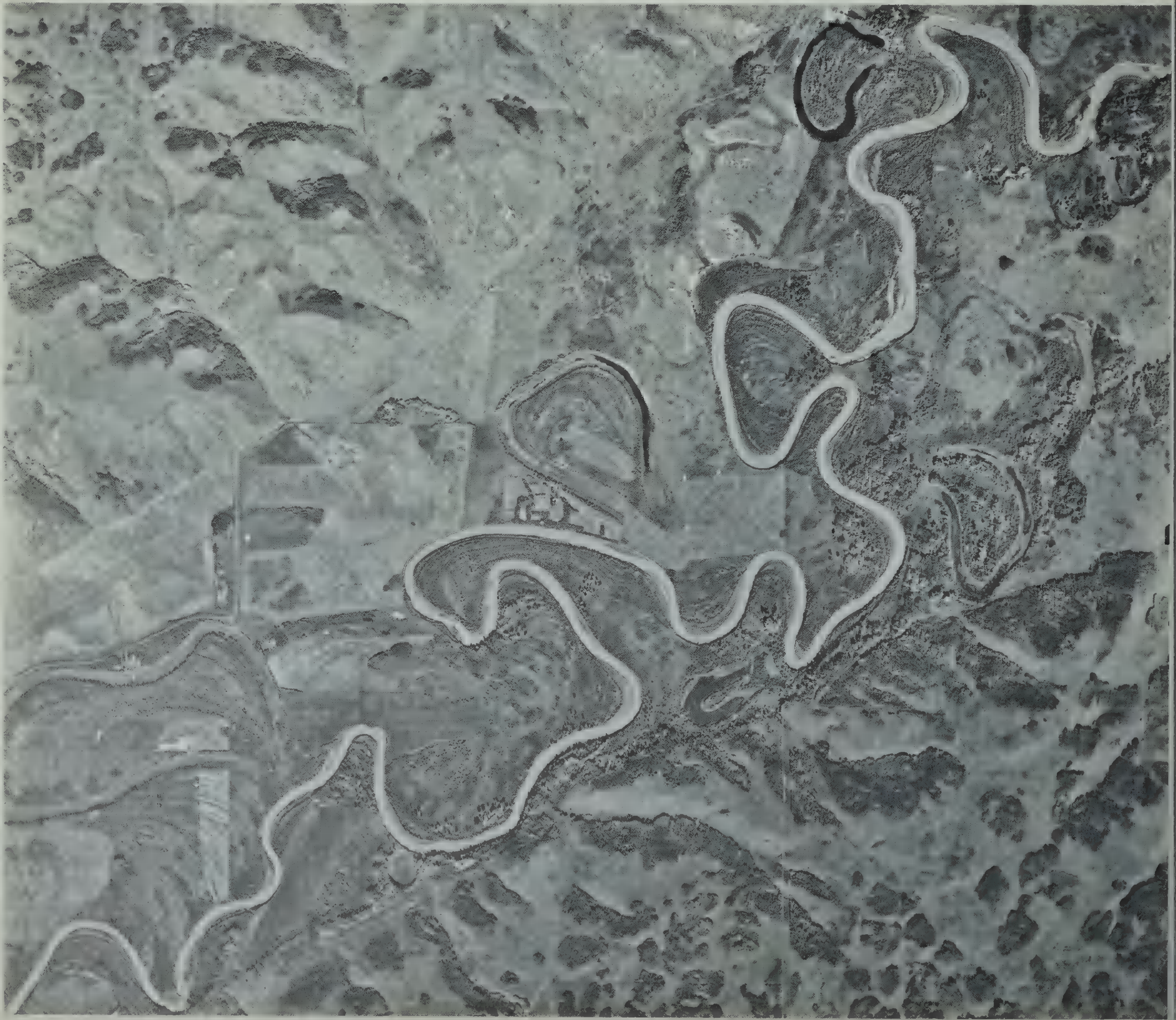
FORT RESOLUTION 2



ROSYTH

The area shown on this map is about 160 miles southeast of Edmonton and about 70 miles from the Saskatchewan border. The entire area is composed of loosely consolidated glacial drift through which a post-glacial spillway cuts a wide, steep-sided valley. This main stream, the Battle River, is an excellent example of a misfit, meandering pseudo-old age stream. Its shallowness is indicated by the existence of fords. Northwest and southeast of the Battle River valley tributary streams have cut deeply into the surface and created the appearance of badland topography.

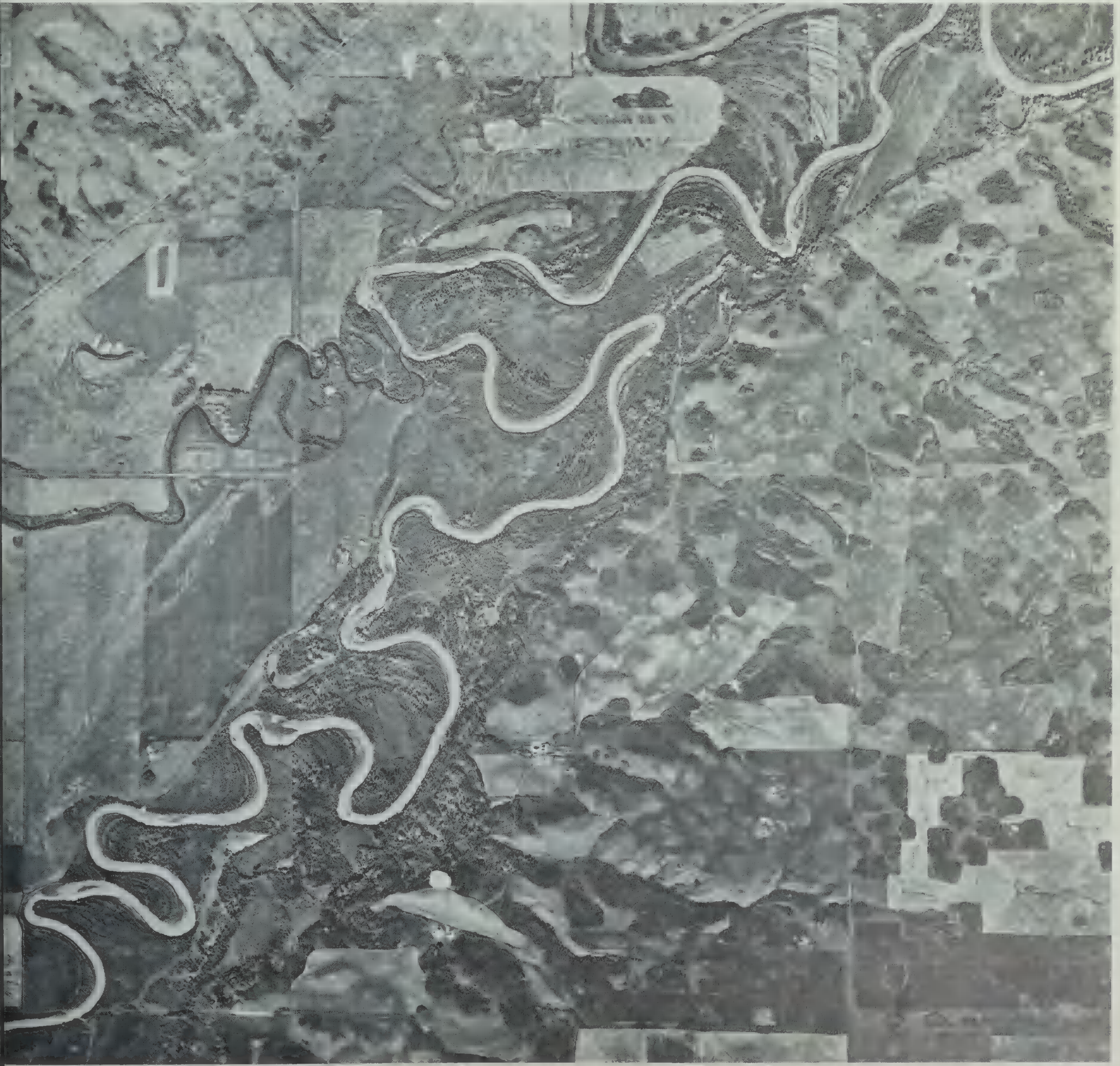
ROSYTH 1



Assignment

1. (*a*) Express the scale of the map as a lineal scale, and give a statement of this in inches and in miles. Express in square miles the area covered by the map.
   (*b*) Locate Photographs 1 and 2 on the map.
2. (*a*) Draw a section or profile from spot elevation 2201 in the northwest, to spot elevation 2181 in the east. Use a vertical interval of $\frac{1}{8}''$ to 10′. Find part of the area shown on the profile on Photograph 1. Label the various features shown on the profile.

ROSYTH 2



(*b*) In which direction is the river flowing? Justify your answer.

(*c*) Find the gradient of the river in the central portion of the map.

3. What climatic features of this area may be ascertained from a study of:
   (*a*) the smaller tributaries on the left bank of the Battle River,
   (*b*) vegetation shown on the map and Photographs 1, 2,
   (*c*) the lakes in the southeast,
   (*d*) Photograph 3?

4. (a) Suggest reasons for calling the Battle River a river of pseudo-old age. Refer to map and photographs.
   (*b*) Refer to Photograph 3 and account for the formations found on both sides of the river and the flat land on the left bank. How might this be prevented?
   (*c*) Study Photograph 2 and the map and classify Iron Creek.

5. Choose an oxbow lake shown on the map and draw sketches to show how the Battle River created this feature. How many oxbow lakes are there on Photograph 1? Where might oxbow lakes be formed in the future?

6. What do the dotted blue lines on the map around some oxbow lakes indicate? Suggest reasons for this condition.

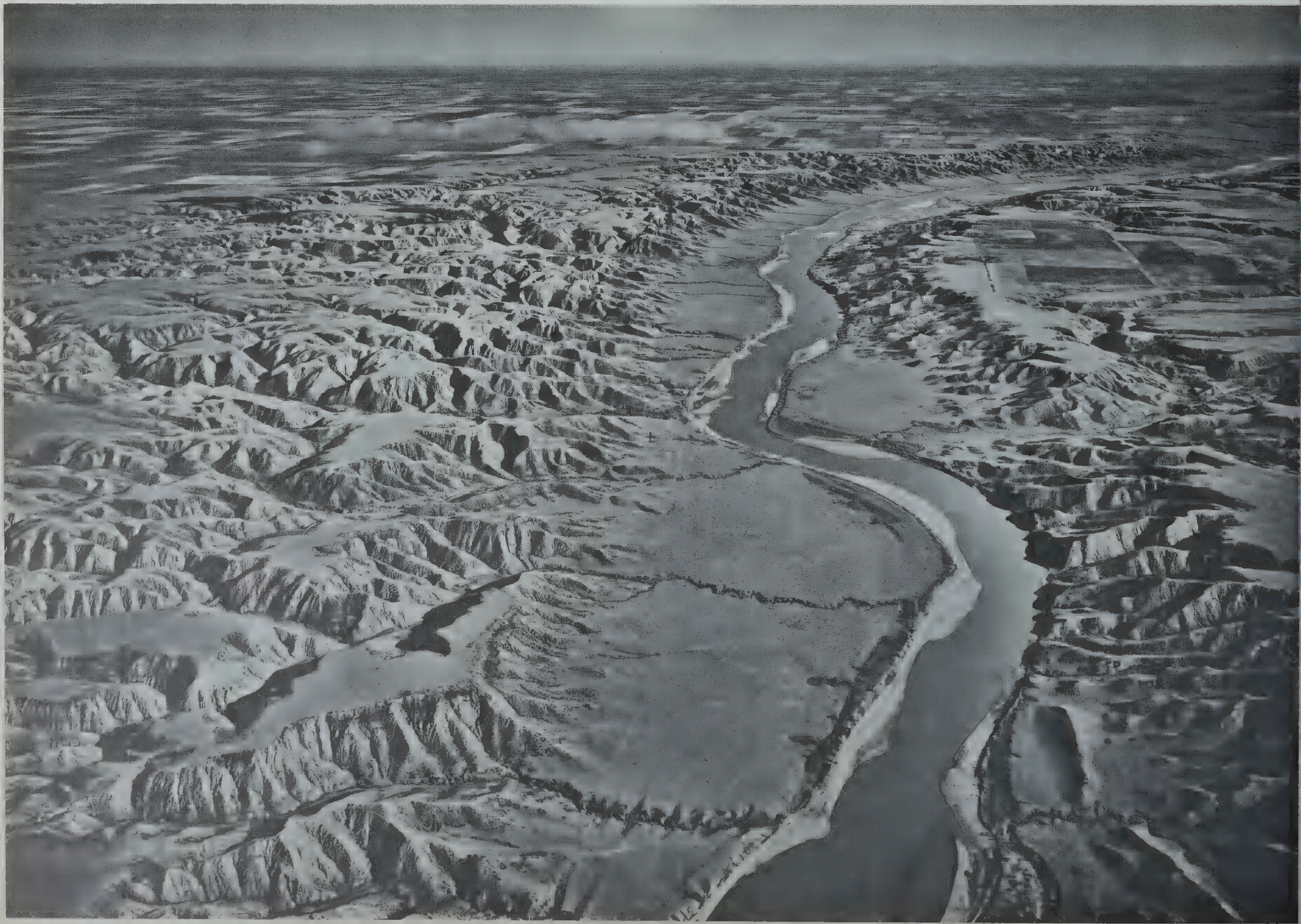
7. Depression contours are indicated on this map by means of a contour line with hachures on the inside of the contour. As an example refer to grid reference 878381. What feature occupies part of this depression? Is it permanent or temporary? Why?

8. (*a*) What similarities exist between the north-west above the 2200′ contour and the south-east portion of the map?
   (*b*) Compare the derivation of the parent material in the soil north and west of the Battle River and in the flood plain itself.

9. (*a*) What features shown on the map have severely limited settlement?
   (*b*) List the land uses shown on the map.

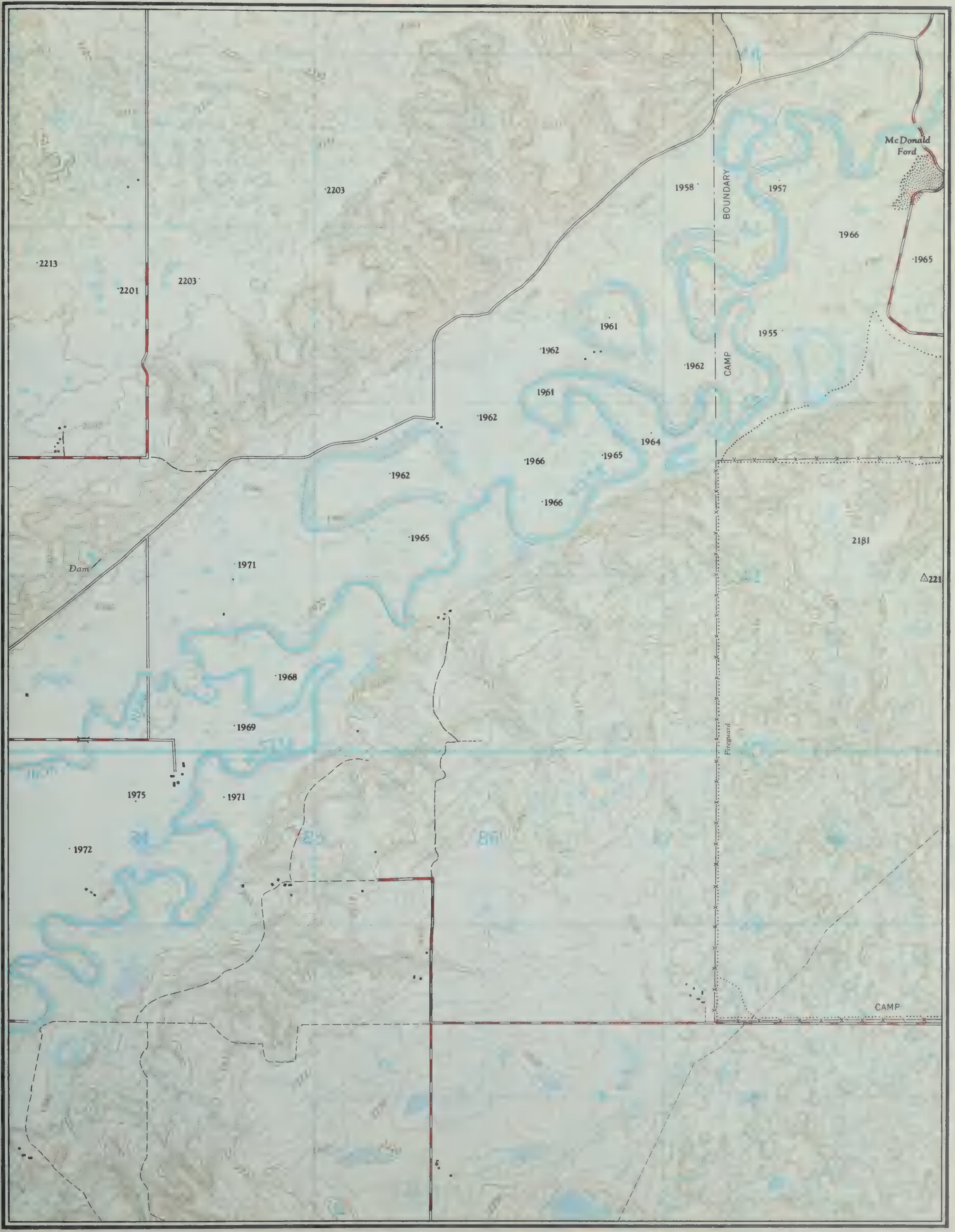
10. (*a*) Compare the population density of the Battle River valley and the plateau land on both sides. Use the 2000′ contour as your divisional point. Account for any difference that exists.
    (*b*) Communication facilities are not extensive in the area. What problems have obviously been difficult to overcome?

ROSYTH 3



ROSYTH

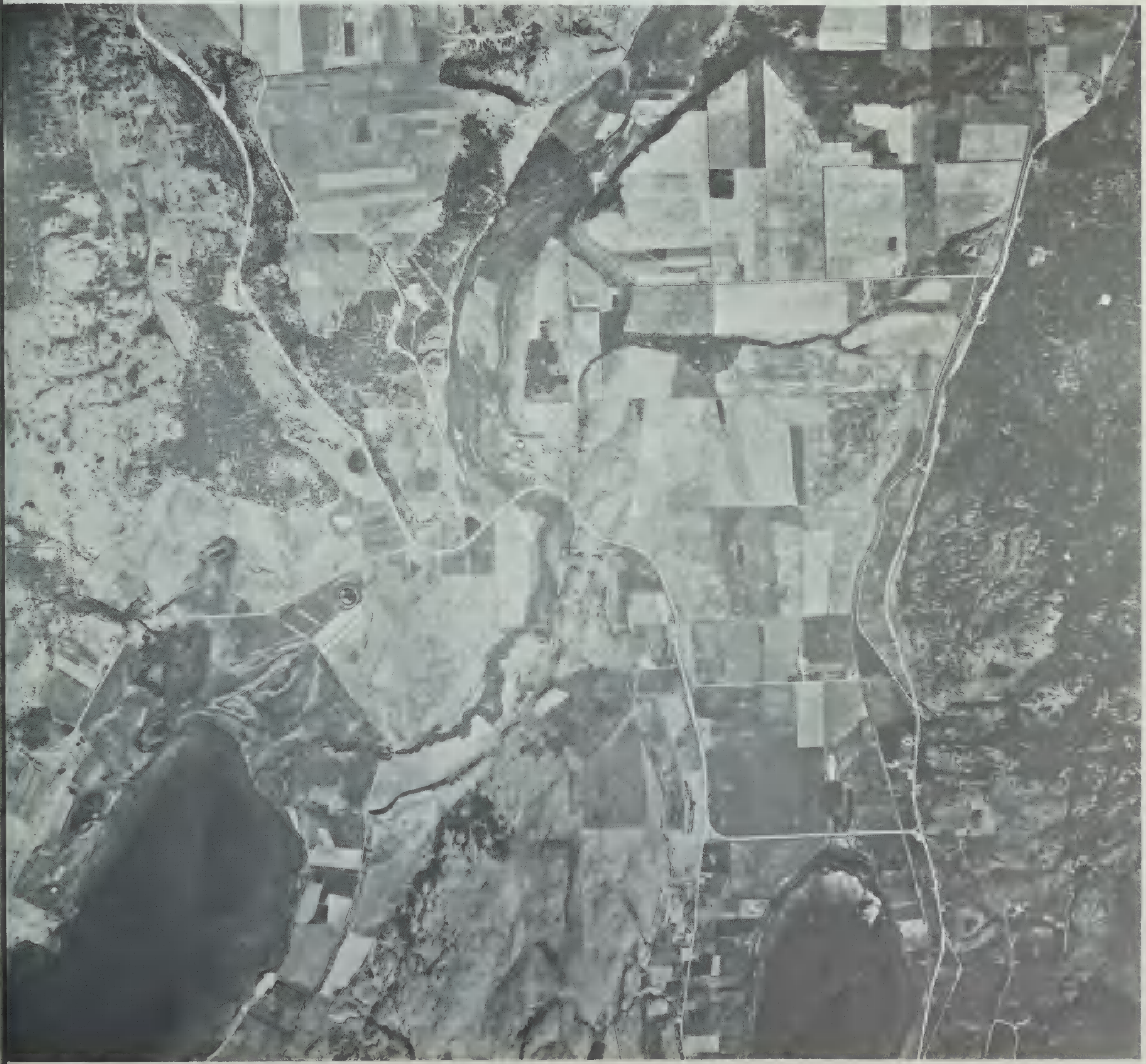
Scale 1: 25,000


2203
2213
2201
2203
1958
BOUNDARY
1957
McDonald Ford
1966
1965
1961
1962
1955
1962
CAMP
1961
1962
1964
1966
1965
1962
1966
1965
2181
△221
Dam
1971
1968
1969
Fireguard
1975
1971
1972
CAMP

ERNON

This area is in the interior of southern British Columbia, and is part of the intermontane plateau and trench area. The Monashee and Midway Mountains — parts of the Columbia System — lie immediately to the east. The large body of water is Okanagan Lake. This entire region was at one time subjected to alpine glaciation, and the beds of the major lakes were created by the gouging action of ice.

VERNON 1



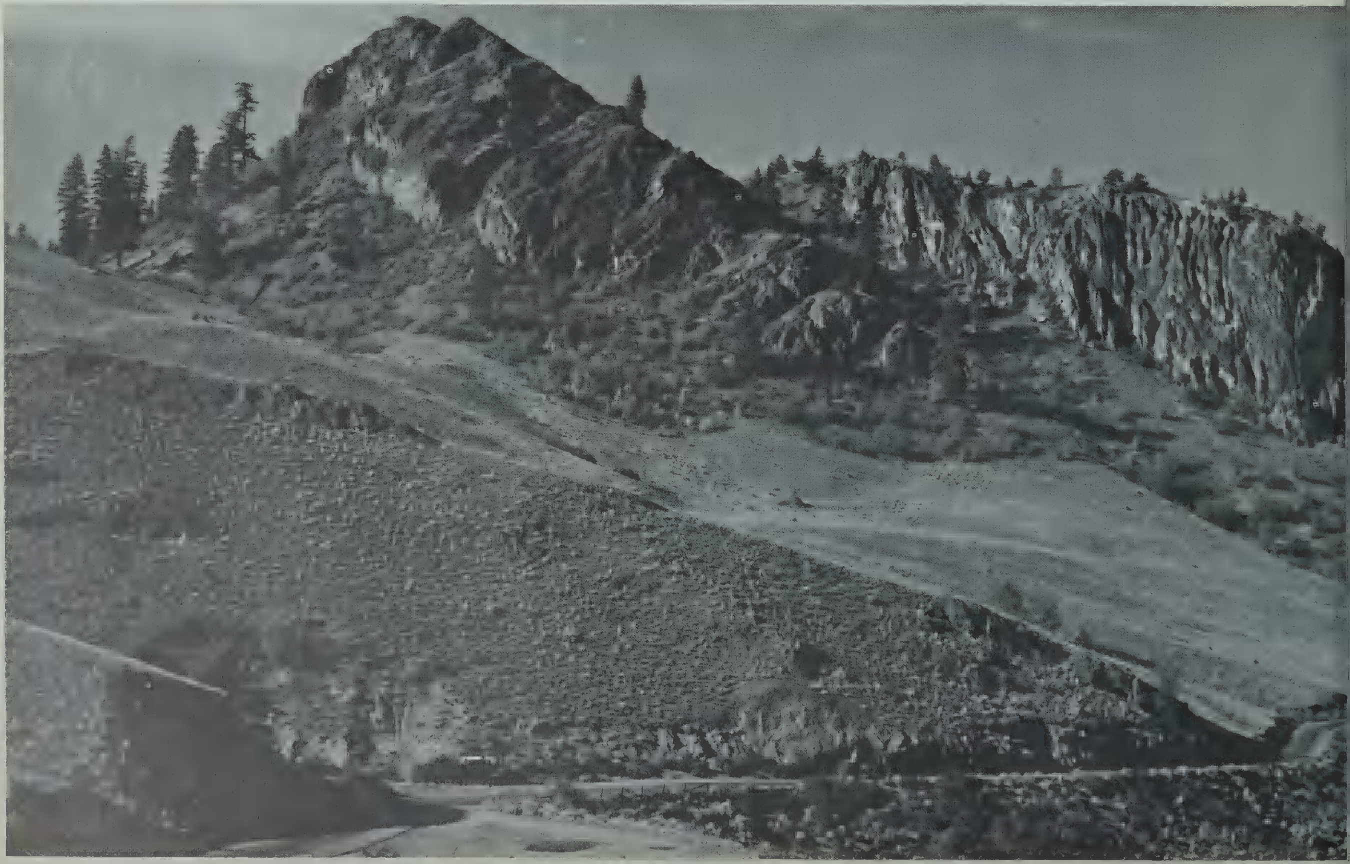
Assignment

1. (*a*) Draw a cross section or profile from grid reference 330790 to 360770. Use a vertical scale of $\frac{1}{8}$" to 50'.
   (*b*) On the profile describe, name, and give the heights of the physical features bordering the lake. What use is made of these features, as shown by Photograph 1?
   (*c*) Account for the lakes and swamp found at the north end of Okanagan Lake, as seen on both the map and Photograph 1.

2. (*a*) What type of feature is Newport Creek on the west side of Okanagan Lake? From a study of its valley, what may be deduced about the rock type over which it flows?
   (*b*) How does the relief of the Okanagan Valley suggest glaciation? How is the extreme flatness of this valley displayed by Deep Creek? How may this creek be identified on Photograph 1?
   (*c*) Find another example of a valley similar to the Okanagan, and find another example of a valley similar to Newport Creek.

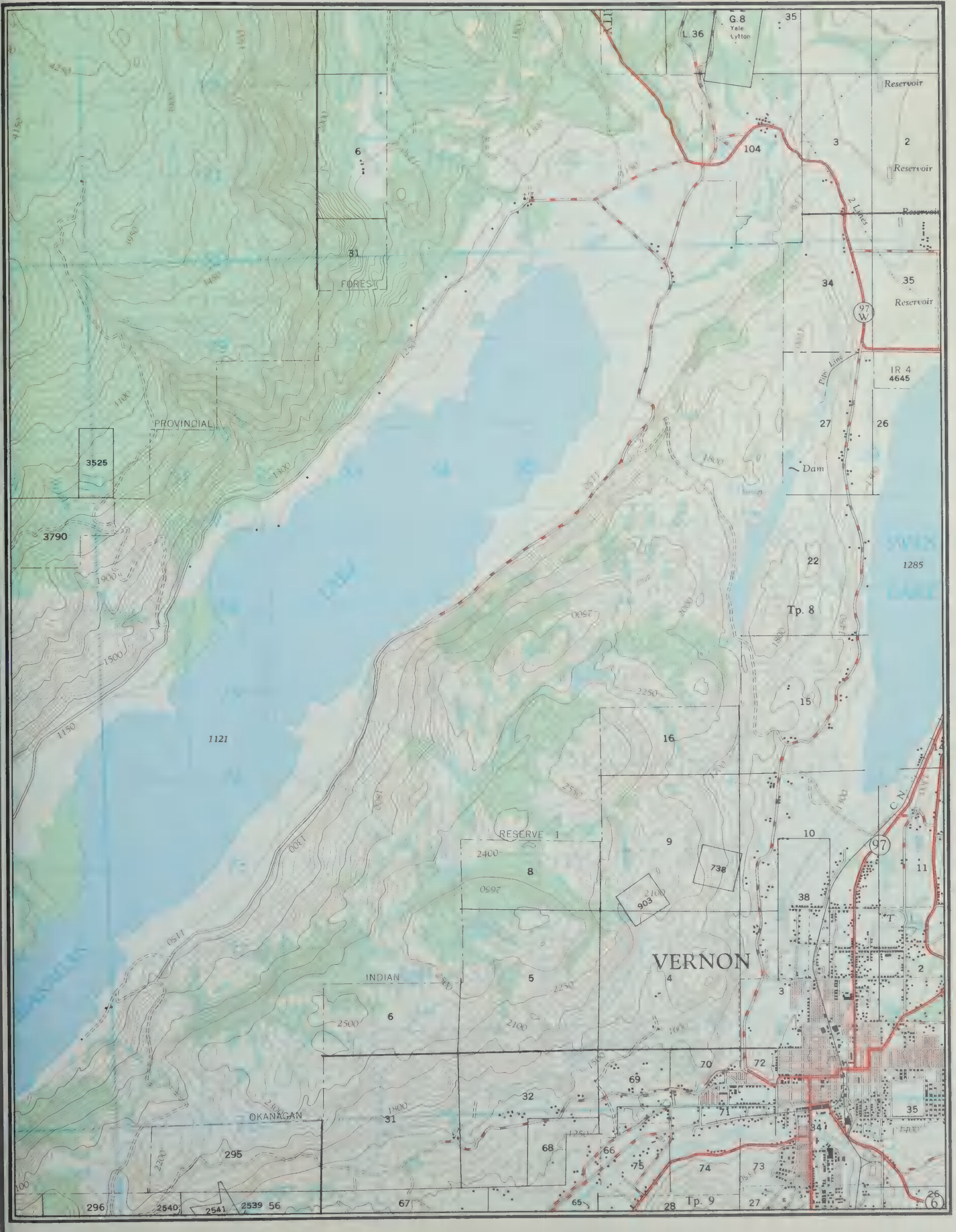
3. (*a*) Find some features on the eastern half of the map and Photograph 2 which would indicate either an arid or a humid climate.
   (*b*) Draw a sketch profile from grid reference 324747 to 373704 and locate this area on Photograph 3. On this profile show the altitudinal zonation of natural vegetation. Refer to Photographs 2 and 3 and the map. Account for this distribution.

VERNON 2



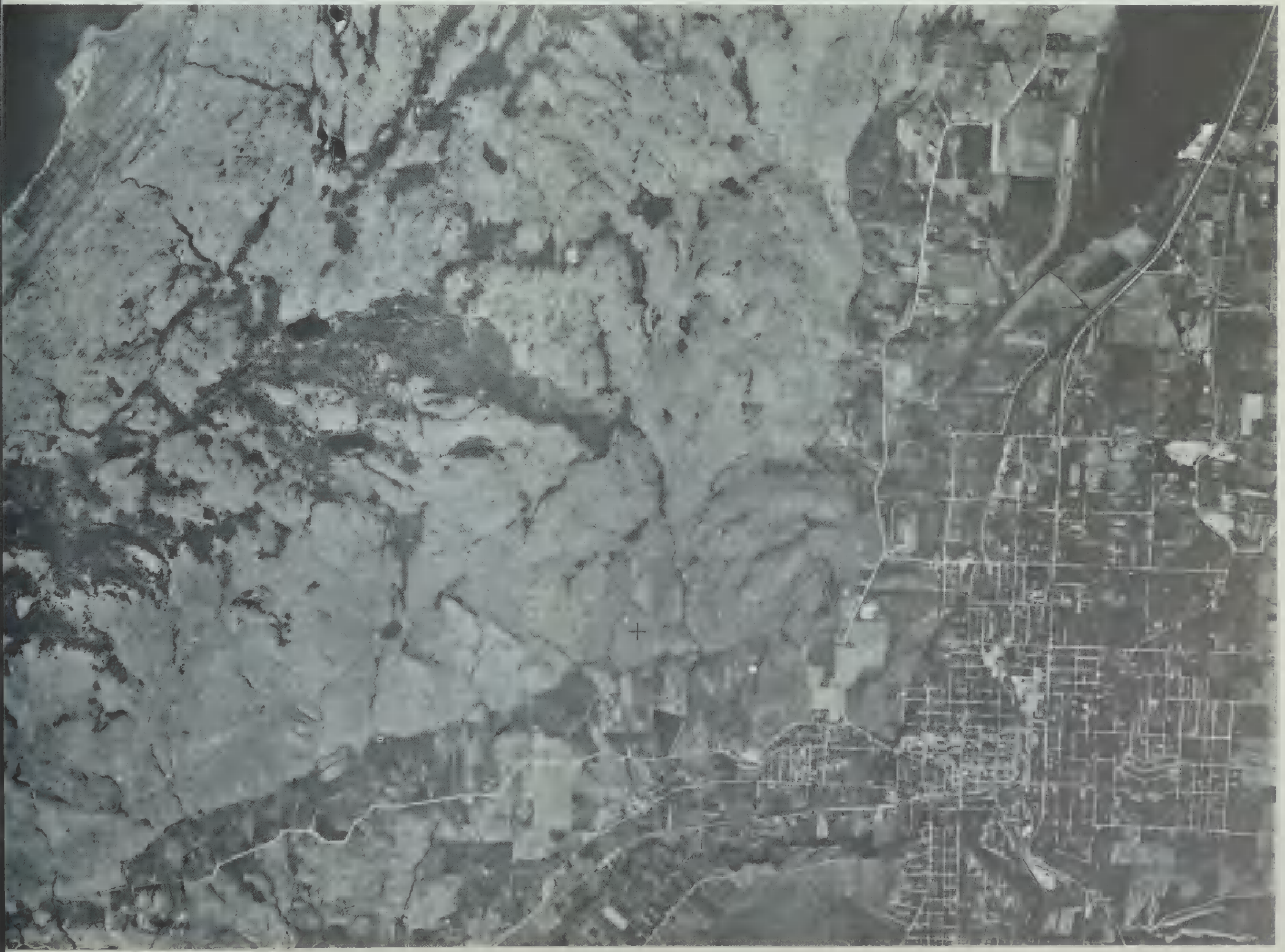
VERNON

Scale 1: 50,000


G.8
Yale
Lytton
L. 36
35
Reservoir
104
3
2
Reservoir
Reservoir
2 Lines
6
31
FOREST
34
35
Reservoir
97
W
PROVINCIAL
3525
IR 4
4645
27
26
Dam
Pipe Line
3790
1285
22
Tp. 8
1121
15
16
RESERVE 1
9
10
97
C.N.
11
8
738
903
38
VERNON
INDIAN
5
4
3
2
6
70
72
69
32
OKANAGAN
31
71
35
295
68
66
34
75
74
73
296
2540
2541
2539
56
67
65
28
Tp. 9
27
26
6
4150
4250
3950
3100
1900
1500
1150
1300
1250
2400
2650
2500
2250
2100
2000
1800
2200
1400

4. (*a*) Study the water-course which enters the south edge of the map at grid reference 315689. What evidence is there that this is man-made and not a natural feature? Locate this feature on Photograph 3. What use does man make of this water-course? How may this water-course be identified as a water-course on the photograph?
   (*b*) Find two natural sources and one man-made source of water for this feature. Identify these on Photographs 1 and 3.
   (*c*) Briefly describe how the artificial source was created and account for its necessity.
5. (*a*) The slope of the land immediately east of the water-course or ditch referred to in question 4 is quite steep. How must farmers have overcome this problem in the area east of Goose Lake? Study both the map and Photograph 3.
   (*b*) How does this type of farming overcome moisture, soil and temperature problems?
   (*c*) Study the area to the north of Okanagan Lake and the area between Swan Lake and the irrigation ditch on Photograph 1. Suggest an altitudinal zonation of crops

VERNON 3



from low-lying land to the middle slopes of the highland.

(*d*) Suggest a possible use that might be made of the higher land above the ditch. Study the middle background of Photograph 2.

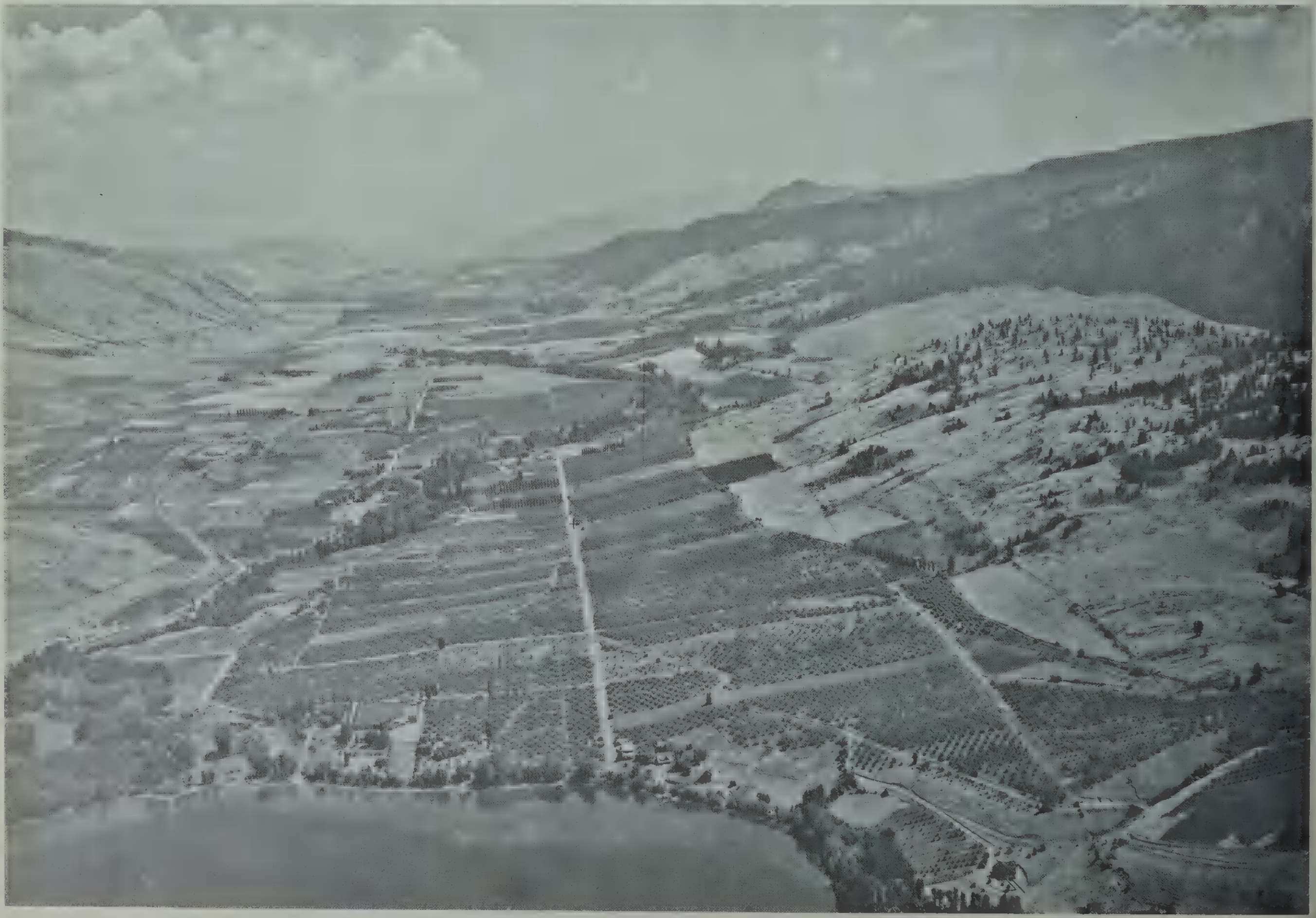
6. Account for the sparsity of settlement along the edge of Okanagan Lake.

7. From your study of the map so far, what economic functions would Vernon perform for the area?

8. (*a*) Why do transportation facilities on the map follow a north-south alignment?
   (*b*) How does this fact create economic problems for the area?

9. Study Photograph 4. This valley is found to the south of Vernon.
   (*a*) What type of valley is this?
   (*b*) Find features on the photograph to support your answer to part (*a*).
   (*c*) Describe agricultural activities (general crop types and their distribution) as seen on the photograph.

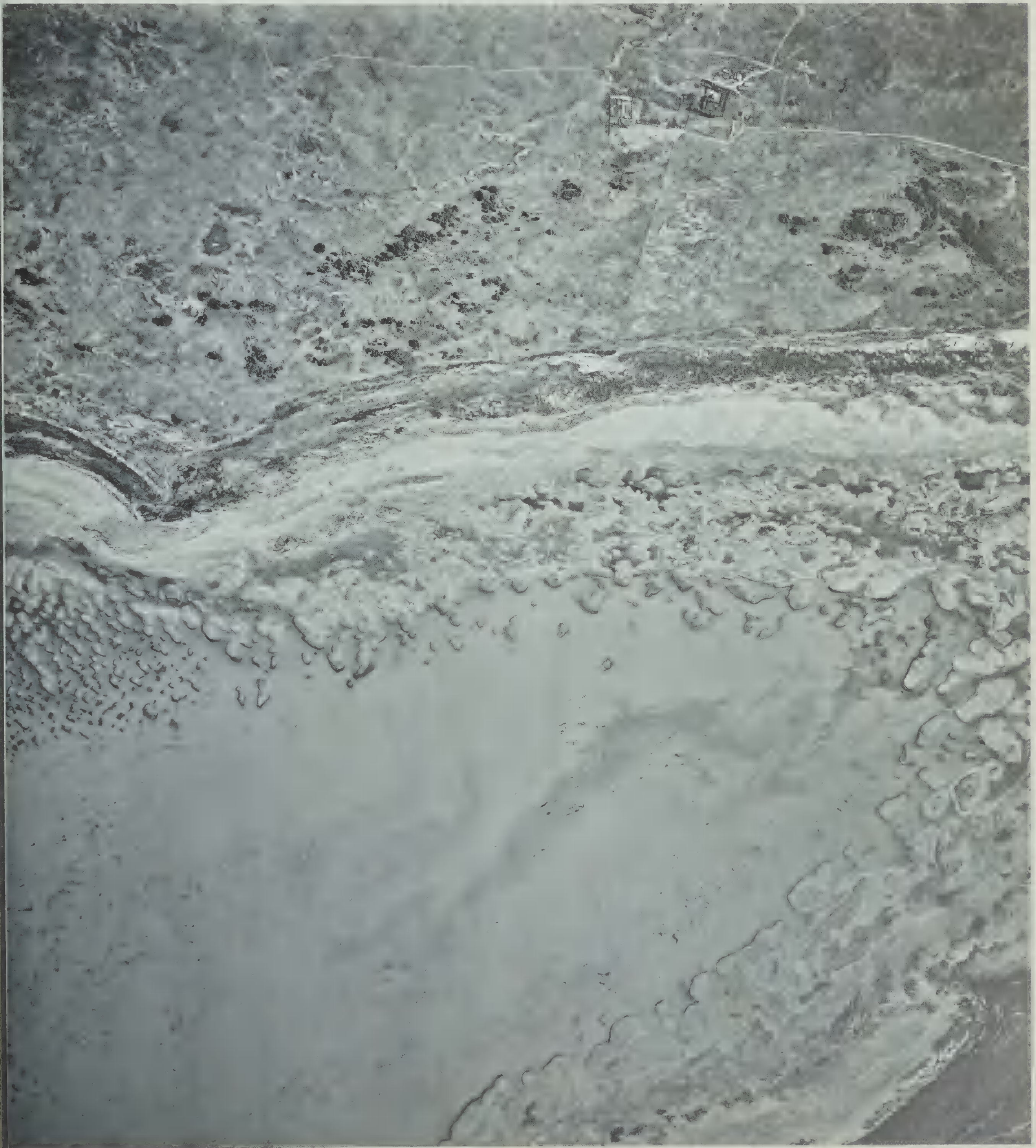
VERNON 4



CRANE LAKE

The area is located in southwestern Saskatchewan about 20 miles north of Cypress Hills. This is a provisional map; on such a map, where no accurate surveys of the area have been carried out, the contour lines and regions of forest are based primarily on aerial surveys, and are printed in black and blue only to indicate their provisional nature.

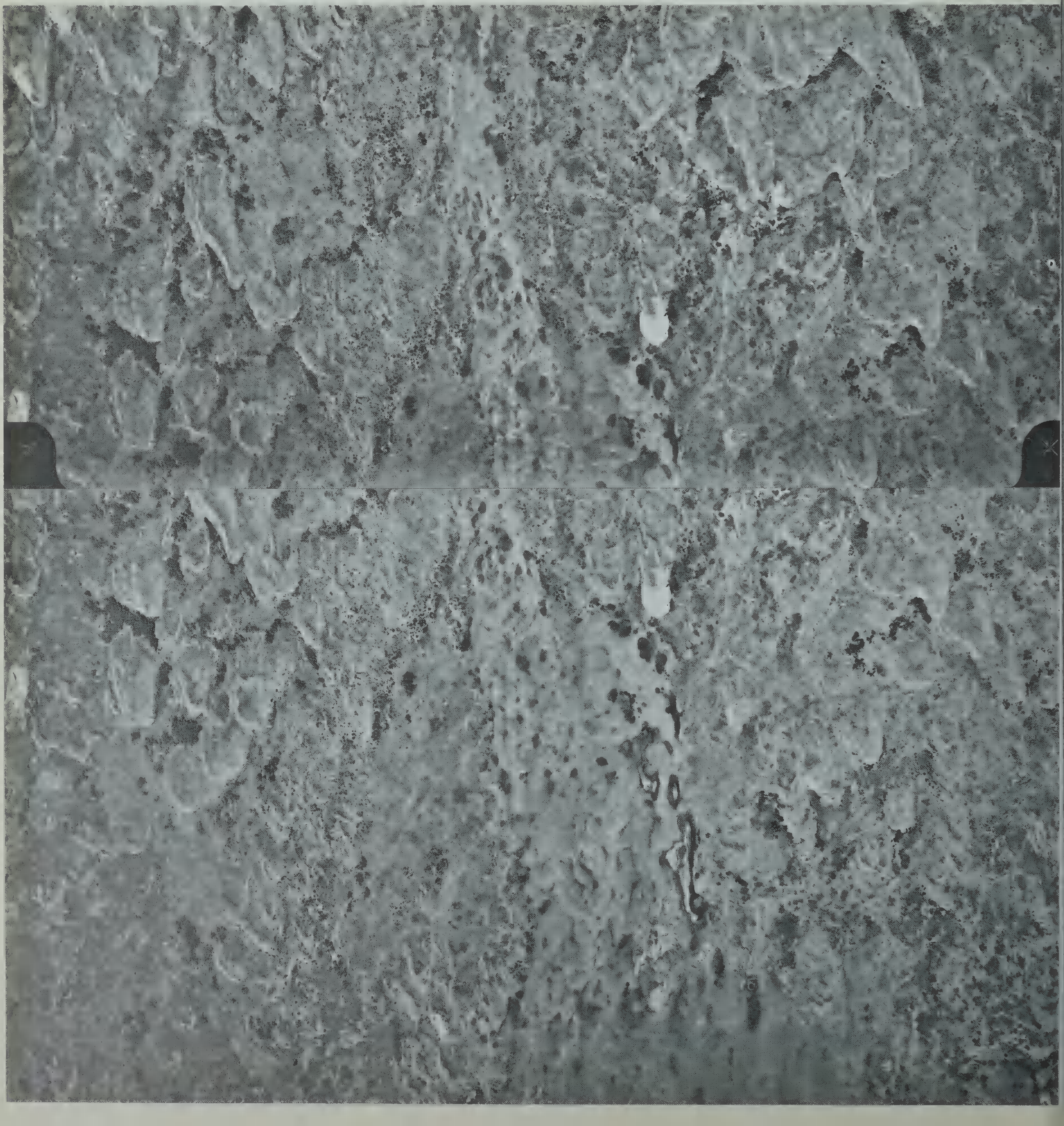
CRANE LAKE 1



Assignment

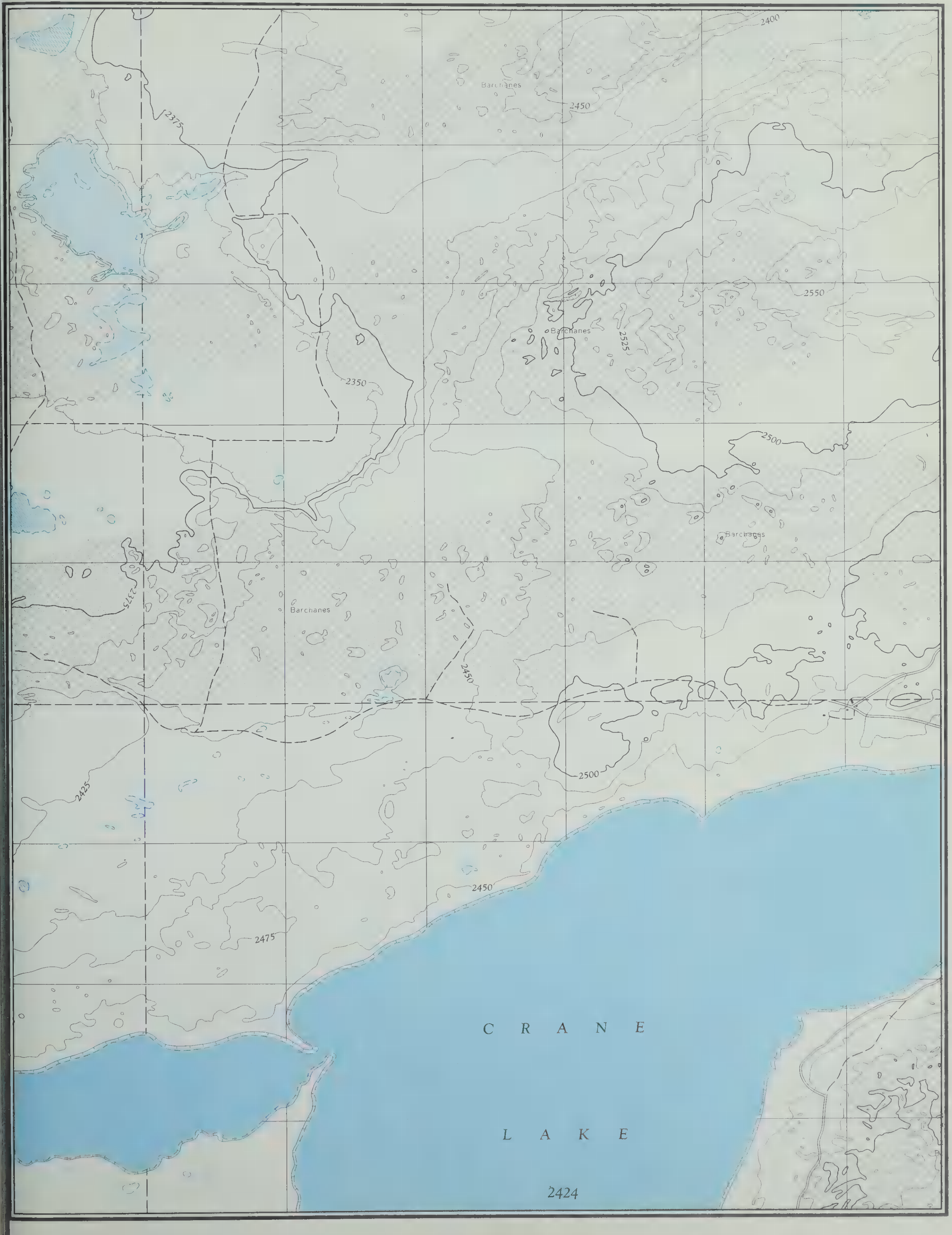
1. (a) What is the range in relief on the map? Generally where is the highest and lowest land?
   (b) What feature is indicated by the contours bordering the lakes in the northwest? How do you know?
2. (*a*) What is meant by the dotted line around Crane Lake? Locate the area shown in Photograph 1 on the map.

CRANE LAKE 2



CRANE LAKE

Scale 1: 50,000


2400
Barchanes
2450
2375
2550
Barchanes
2525
2350
2500
Barchanes
2375
Barchanes
2450
2500
2425
2450
2475
C R A N E
L A K E
2424

(*b*) With reference to the map, how is Crane Lake different from the lakes of the northwest? What geographic term describes these latter lakes? What evidence is there on Photograph 1 that the shoreline of Crane Lake fluctuates?

(*c*) What is the significance of the fact there are no rivers leaving the lakes of the northwest?

3. (*a*) What is meant by the term barchanes? How are they formed? What does their presence indicate about the physical geography of the area?

   (*b*) Study the stereo photograph. Describe the shape of a typical barchane. Which is the steepest side? What does the shape indicate about the prevailing winds?

   (*c*) Is there anything on the stereo photograph to indicate that most of the barchanes are fixed? Is there anything to indicate that some are moving?

4. Aside from the barchanes, what indications are there on the map of an arid climate?

5. From a study of the map and the photographs, what is the dominant form of vegetation? What type of soil will result from the climate and vegetation?

6. (*a*) Locate on the map the farm shown on Photograph 1. From a study of both the map and the photographs suggest a possible land use for the area. What are the dangers inherent in such a land use in this area?

   (*b*) Find on the photographs some of the trails shown on the map. Suggest a reason for the existence of these trails.

BIBLIOTHEQUE
DU
COLLEGE S[illegible]
EDMONTON, A[illegible]

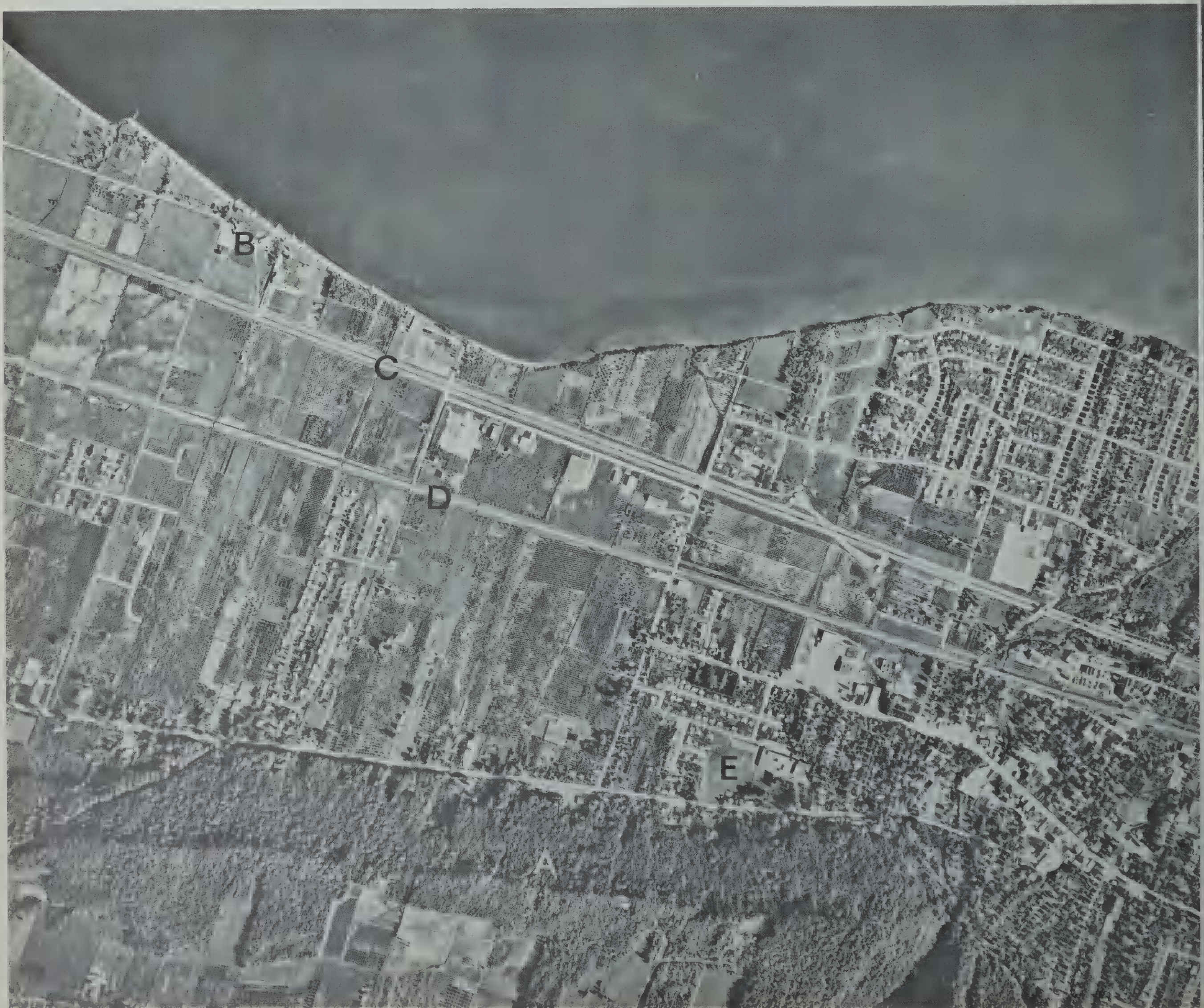
GRIMSBY

The area shown is in the Niagara Peninsula east of Hamilton, in Ontario. The southern half of the region shown on the map is composed of limestone cuesta covered by a thin mantle of glacial till.

Assignment

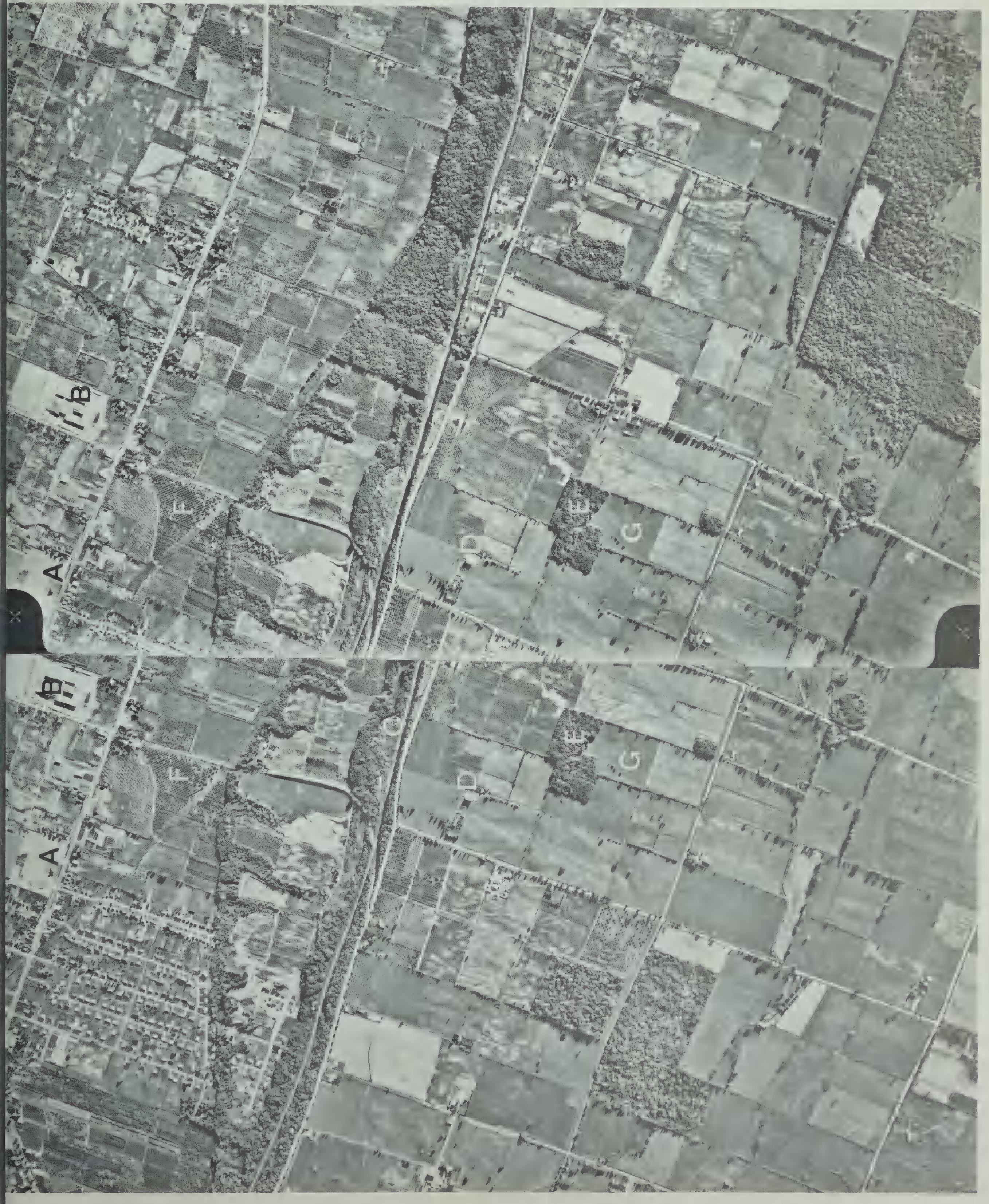
1. (*a*) The total area of the fruit belt between the foot of the Niagara Escarpment and Lake Ontario is approximately 400 square miles. What fraction of this total area is shown on the map?
   (*b*) How does the escarpment appear on Photograph 1?
   (*c*) Locate Photograph 1 on the map. The town in the southeast part of the photograph is Grimsby. Determine the square mile area of the land between the escarpment and the lake on the photograph.

GRIMSBY 1



GRIMSBY 2

←


A
B
F
D
E
G
B
A
F
D
E
G

2. (*a*) Draw a profile or cross section from the centre of the community of Cherry Beach to Tapleytown. Label your profile using these terms: Scarp Slope, Niagara Escarpment, Raised Beach, Old Lake Bed. Use a vertical scale of $\frac{1}{8}''$ to 25′.
   (*b*) Refer to both Photograph 1 and the map and identify the type of material most prominent along the shoreline. Where is erosion taking place in the area shown on Photograph 1? Suggest a reason for it.
   (*c*) Using map, profile and Photograph 1 suggest three reasons for considering this a shoreline of emergence.
   (*d*) Give the grid reference for another example of a raised beach.
   (*e*) Between the shoreline deposits and the escarpment lies the fruit belt. What type of soil would be most prevalent in this area?
   (*f*) The sedimentary material of which the cuesta is composed resists mechanical erosion and pre-dates glaciation. What type of material is this? Most escarpments have a dip slope. Suggest a reason for the absence of a well-marked dip slope in this case.
   (*g*) Indicate the soil types defined in (*e*) and (*f*) on your profile.

3. (*a*) Forty Mile Creek is the main stream on the Niagara Cuesta. Account for the fact that it drains from west to east rather than from north to south along the dip slope.
   (*b*) At what point and by what means does the creek finally descend from the cuesta? Find this point on the map and Photograph 1. Account for the change in the character of Forty Mile Creek at this point.

4. (*a*) What evidence is there that the land below the escarpment is more highly developed economically than the land on the escarpment? Refer to both map and photographs.
   (*b*) List the major agricultural and industrial land uses below the escarpment.
   (*c*) What climatic advantages does fruit farming have below the escarpment that would not be present on the escarpment?
   (*d*) Suggest possible types of farming on the escarpment.
   (*e*) Identify the features shown on Photograph 1 by the letters A to E.

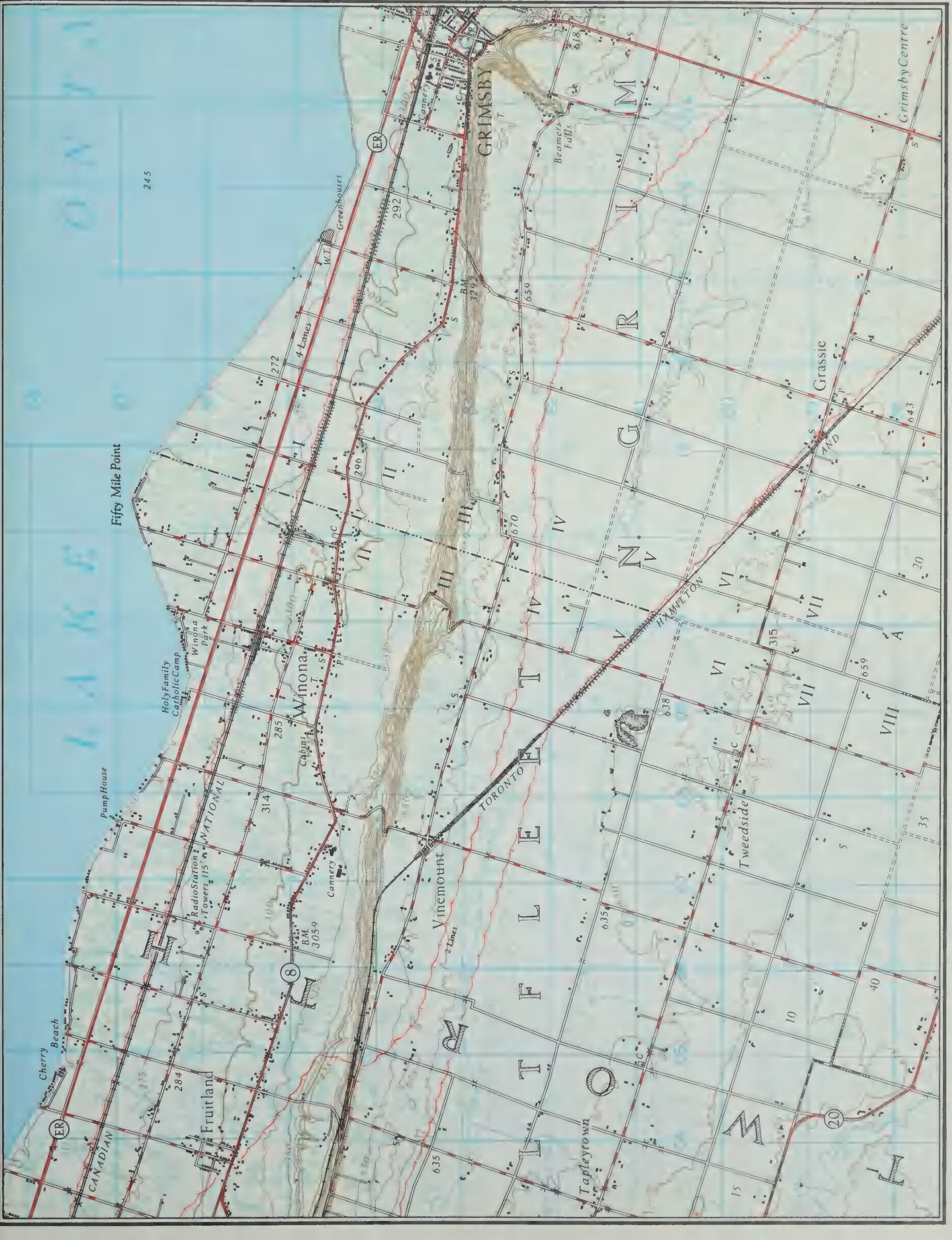
5. (*a*) In which directions do most major routes (rail and road) run? Why?
   (*b*) In which part of the map are most transportation facilities concentrated?
   (*c*) What advantages lay in the construction of these facilities in this part?
   (*d*) What land uses were introduced by the concentration of transportation facilities in this part? What problems were thus created for the farmers?
   (*e*) What other route could have been selected for the Queen Elizabeth Way? What advantage would it have offered?
   (*f*) By what means must the Toronto, Hamilton and Buffalo Railway descend from the escarpment?

6. Photograph 2 is a stereo of the Niagara Escarpment.
   (*a*) Identify those features in stereo already identified on the profile in question 2.
   (*b*) Identify the natural vegetation found on the edge of the escarpment.
   (*c*) Determine the main land uses found on the raised beach.
   (*d*) Name the town found at the foot of the raised beach.
   (*e*) Identify the features shown by the letters A to G on the stereo.

7. What are the main functions performed by such centres as Winona, Fruitland and Grimsby?

GRIMSBY ←

Scale 1: 50,000


LAKE ONTARIO
245
Fifty Mile Point
Pump House
Holy Family Catholic Camp
Winona Park
Cherry Beach
Fruitland
Radio Station Towers 115
CANADIAN NATIONAL
ER
8
20
W.T.
Greenhouses
4 Lanes
272
292
296
285
314
284
275
Cannery
Winona
T.
Cabins
Cannery
B.M. 3059
B.M. 3292
GRIMSBY
Beamers Falls
618
659
670
635
638
643
659
315
Vinemount
2 Lines
TORONTO AND HAMILTON
Tweedside
Tapleytown
Grassie
Grimsby Centre
I
II
III
IV
V
VI
VII
VIII
A
5
10
15
20
35
40

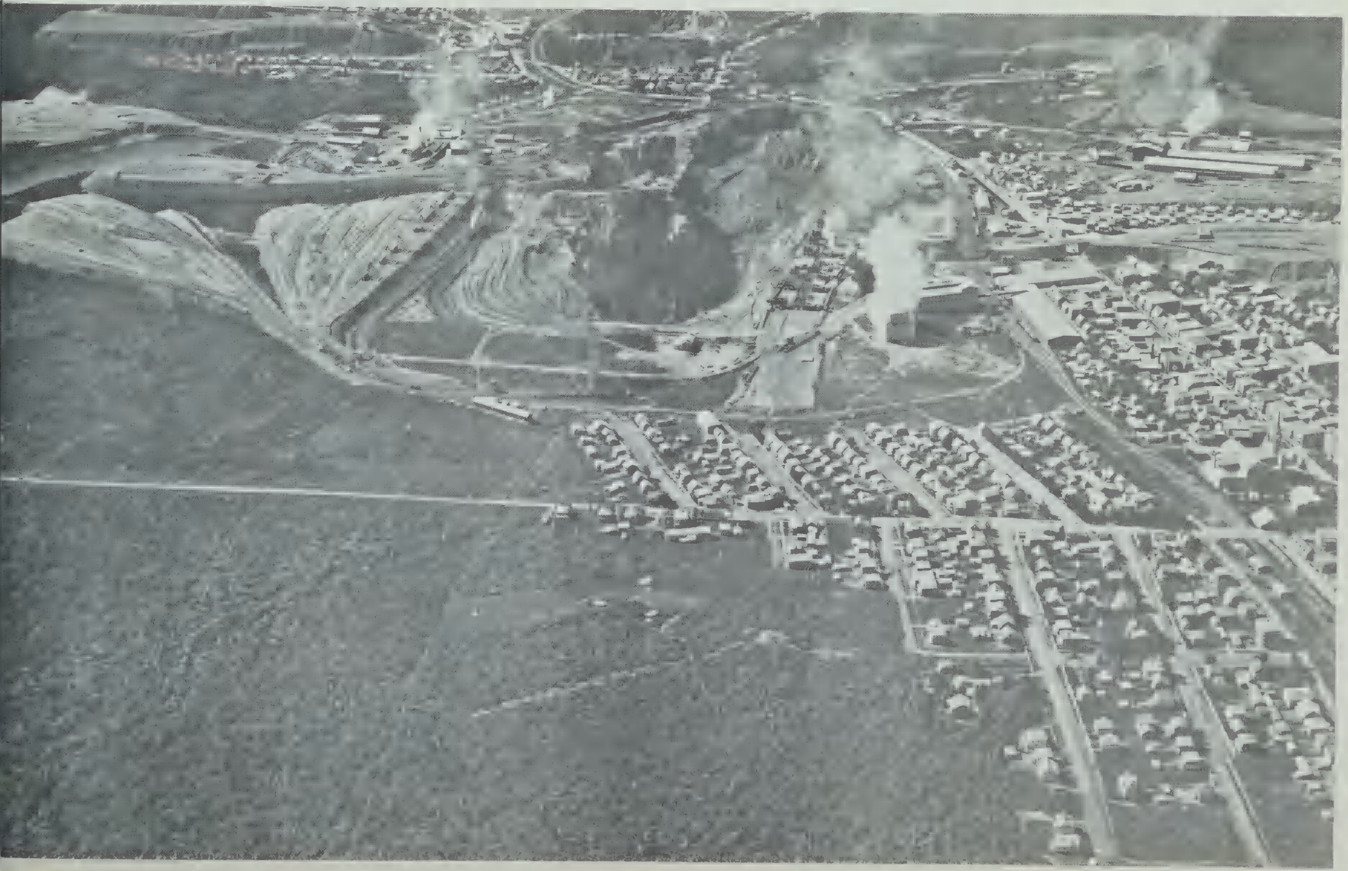
THETFORD

This area is in the Eastern Townships of Quebec, in the southeastern part of the province, and is part of the Appalachian Mountain system. Thetford lies on the eastern flank of the Sutton Range which is a continuation of the Green Mountains of Vermont. The Green Mountains were formed in Paleozoic times and stood then as high mountains. Since that period, however, they have been subjected to severe erosion, intrusion, uplift, and in post-glacial times covered with deep layers of till.

Assignment

1. (*a*) Find the approximate area of the mine at grid reference 244109.
   (*b*) What evidence is there on the map of the product mined throughout this area?
   (*c*) What mining method is used? What is done with the debris from the mining? Study Photographs 1 and 2 and the map.
2. (*a*) What word best describes the course of the Bécancour River? Justify your answer. Black Lake, into which the river flows, is at an elevation of 751′ above sea level.
   (*b*) What words best describe the surface features of the land to the extreme north?

THETFORD 1



(*c*) Explain the geological formation of such hills as Granite Hill in the southeastern part of the map.

(*d*) What does the answer to (*c*) tell about the formation of the mineral mined in the area?

3. (*a*) What is the drainage pattern of the tributaries of the Bécancour River?

(*b*) Why are dams and reservoirs easily constructed on these tributaries?

(*c*) Why are dams and reservoirs numerous in the area? What other use is often made of these constructions? Why does the map not indicate such a use here?

4. (*a*) What are the dominant forms of vegetation shown on the photographs and the map?

(*b*) Is there any indication on the map that commercial use is made of the vegetation? Where?

(*c*) Locate the main agricultural area. What evidence is there on the map of agriculture in this area?

5. (*a*) Describe the terrain on which the city of Thetford Mines was built.

(*b*) What is the main way in which the city is expanding? What factors dictated the choice of this direction?

(*c*) How many major economic activities are there in Thetford Mines? What problem is inherent in such a situation?

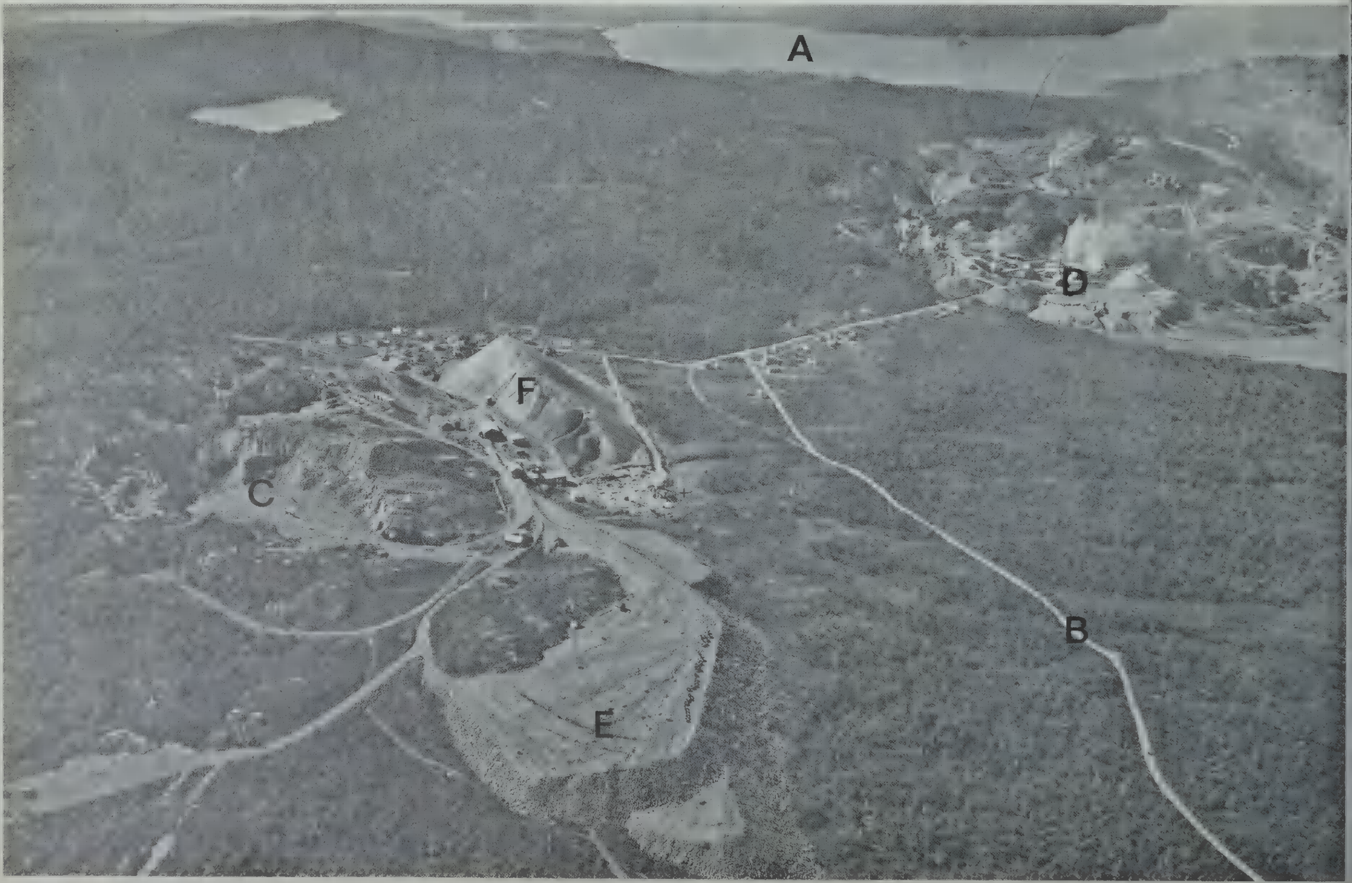
6. Both photographs were taken facing southwest.

(*a*) Identify by grid reference the large mine shown in the upper centre of Photograph 1.

(*b*) Identify on Photograph 2:

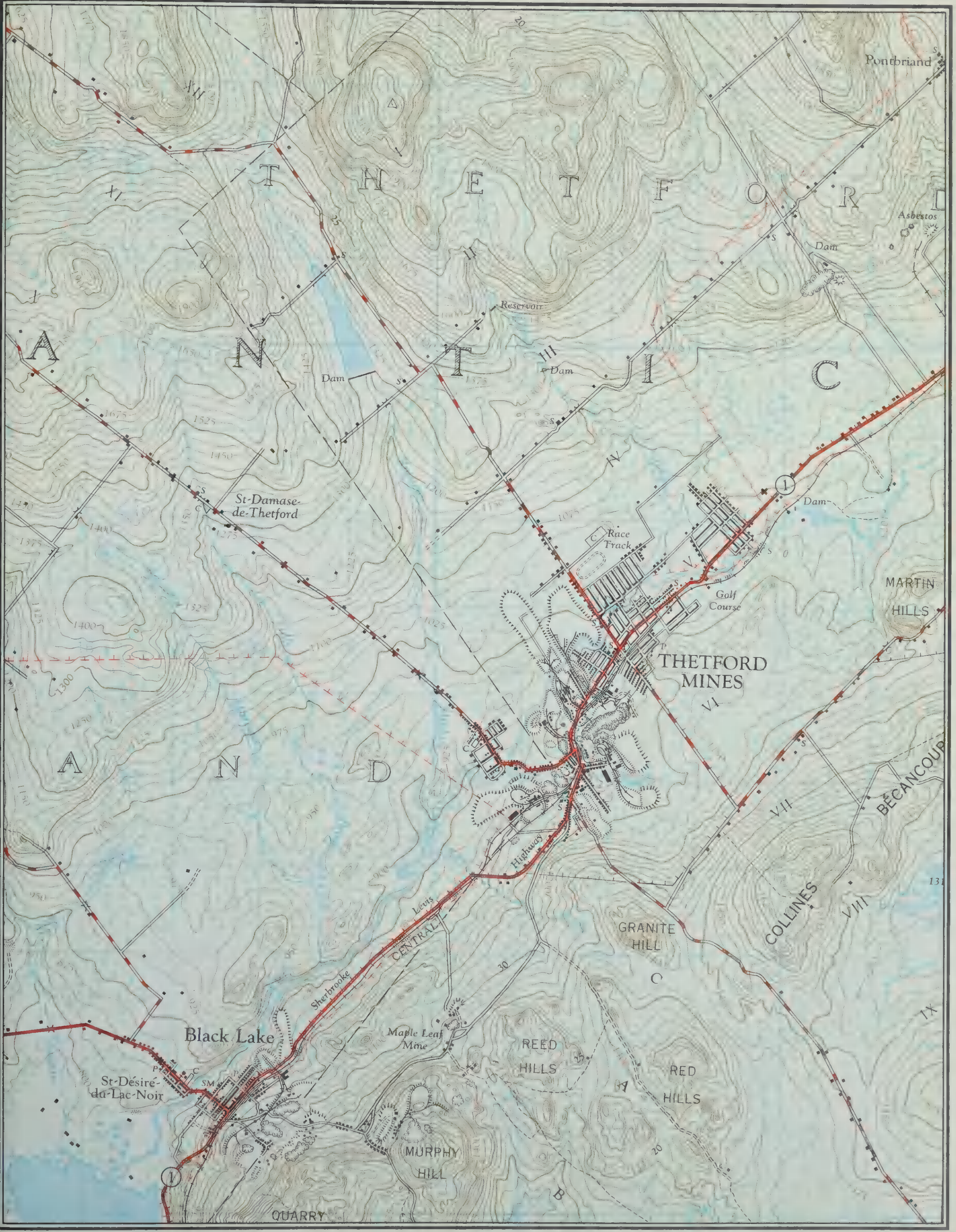
  (i) the body of water lettered A,
  (ii) the road lettered B,
  (iii) the function performed at the site lettered C,
  (iv) the function performed at the site lettered D,
  (v) the type of material at E,
  (vi) the type of material at F.

THETFORD 2



THETFORD

Scale 1: 50,000


T H E T F O R D
A N T I C
A N D
Pontbriand
Asbestos
Dam
Reservoir
Dam
Dam
St-Damase-de-Thetford
Race Track
Golf Course
Dam
MARTIN HILLS
THETFORD MINES
Highway
Levis
CENTRAL
Sherbrooke
GRANITE HILL
COLLINES
BÉCANCOUR
Black Lake
St-Désiré-du-Lac-Noir
Maple Leaf Mine
REED HILLS
RED HILLS
MURPHY HILL
QUARRY
1
1
II
III
IV
V
VI
VII
VIII
IX
XI
XII
20
25
30

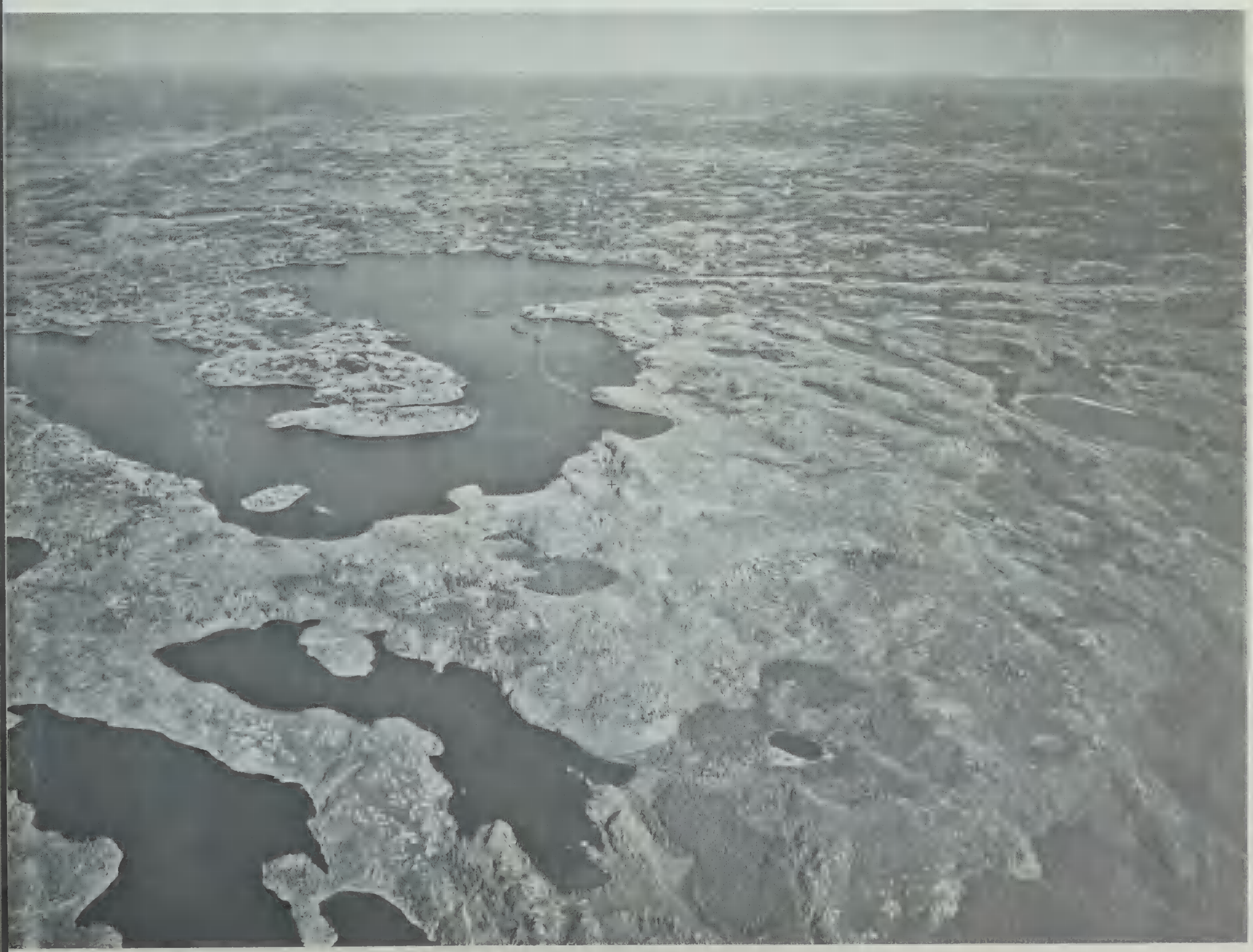
QUETICO (Atikokan)

The area shown is in northwestern Ontario, about 100 miles west of Port Arthur and Fort Williams, and 30 miles north of the United States border. The southern quarter of the area depicted is part of the Quetico Provincial Park.

Assignment

1. (*a*) Find evidence on the map to indicate that the Seine River flows from the north-east to the south-west in this area.
   (*b*) Through how many feet does the river drop in that part of the course shown? What features account for most of this drop?
   (*c*) What is the approximate range of relief in this area?
   (*d*) From a study of Photograph 1, what was the main agent of erosion that sculptured this area? Describe the effect this agent has had on soils and landscape.

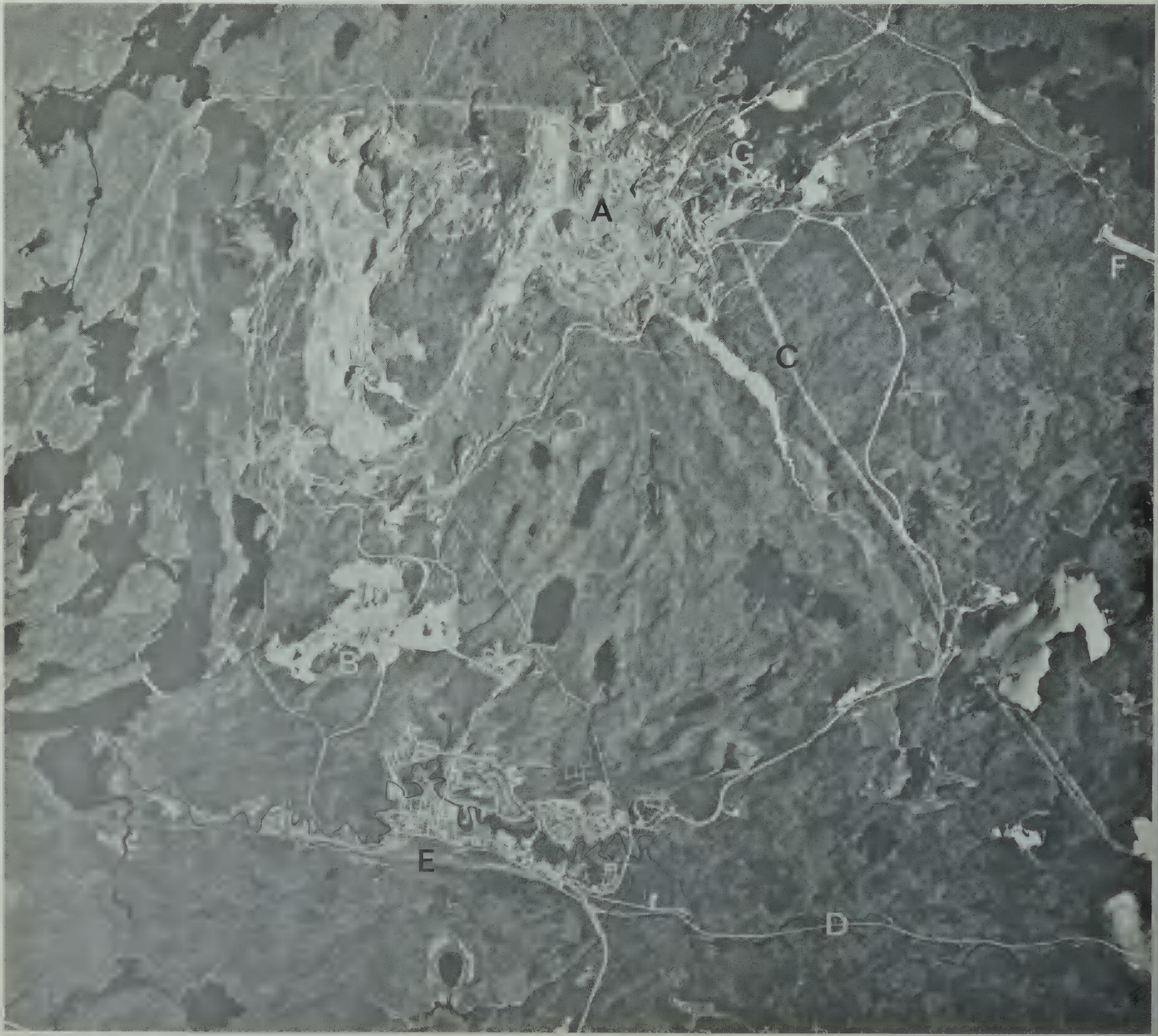
QUETICO 1



2. (*a*) This area receives only 20″ of rainfall a year. Why then is there so much water present? Describe and account for the nature of the drainage. What effect does this have on the water table?
   (*b*) In view of the drainage situation, suggest the types of rock that are probably most common.
   (*c*) To what physiographic region of Canada does this area belong? Defend your answer.

3. (*a*) What are the chief land uses evident on the map? Study the map and Photographs 2, 3, and 4.
   (*b*) What indication is there on the map of the mineral product found to the east of Atikokan? Eventually large deposits of this mineral were found at Steep Rock Lake.

QUETICO 2



(*c*) Locate on the map the horseshoe-shaped lake shown in the left centre of Photograph 1. It is about 3 miles north of Atikokan. In what way has this lake been changed since the photograph was taken? Photograph 2 is quite recent. What is the present state of Steep Rock Lake? Why do you think this project was undertaken?

(*d*) From a close study of the map describe the steps involved in preparing the mine area for production.

(*e*) From Photograph 3 describe the mining methods practised. What indication is there on this photograph of the original level of the lake?

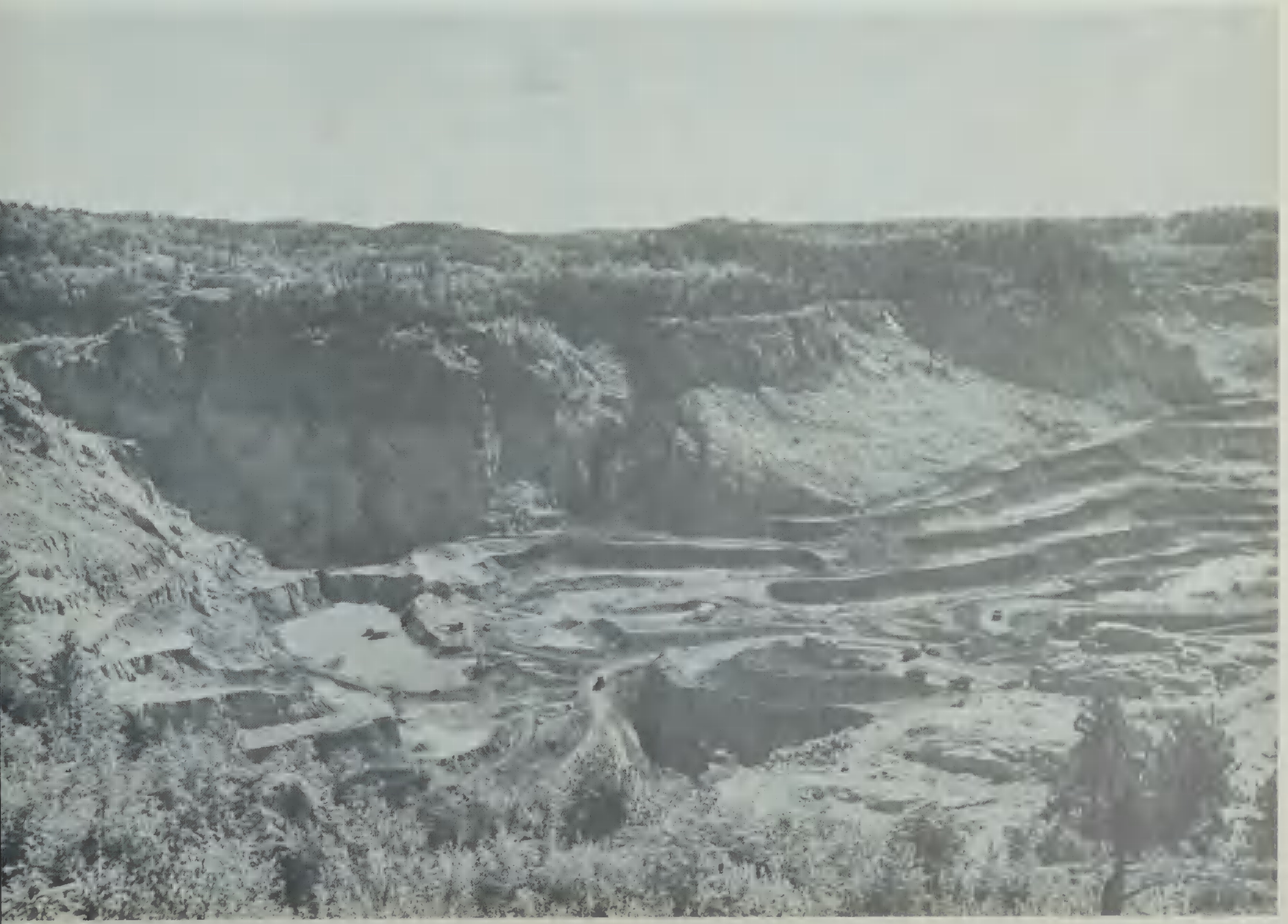
4. (*a*) How does the ore get from the mine to Atikokan? By what means is it exported from there? Study the map and Photographs 2 and 4.

(*b*) What indications are there that the Atikokan-Steep Rock project is relatively recent?

(*c*) Suggest another important function served by the railway shown.

(*d*) Identify the features shown by the capital letters A to G on Photograph 2. In the case of B see also Photograph 4. In all cases refer to the map as well.

QUETICO 3



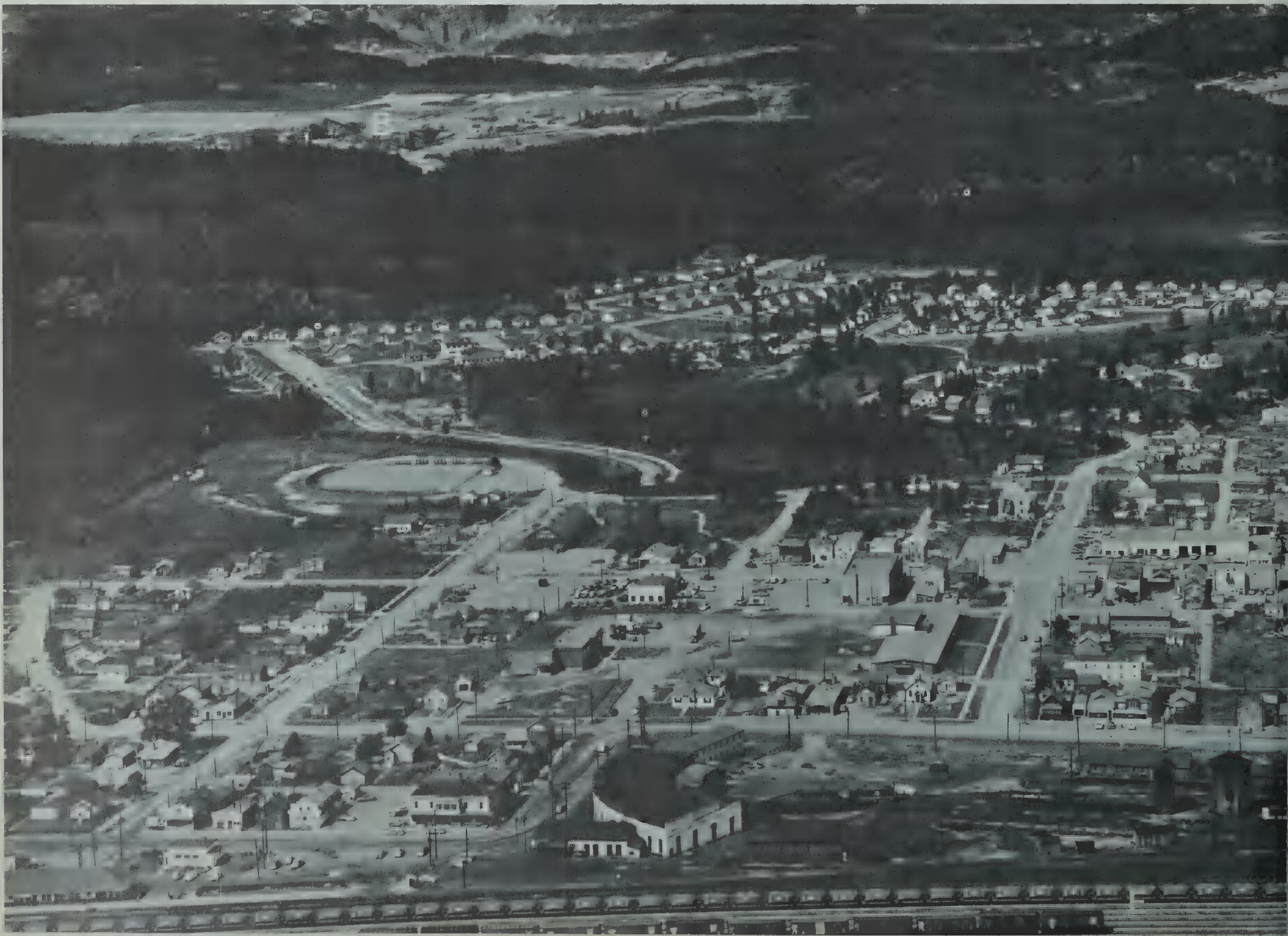
5. (*a*) What means of transportation other than rail serve the area?
   (*b*) What evidence is there on the map of how man crossed this area prior to road and rail?
   (*c*) How is the overabundance of water used today in transportation?
   (*d*) What is the significance of the + and — signs after the figure giving the elevation of each lake?

6. (*a*) Study Photograph 4. On what basis could the town of Atikokan be divided into two parts? Explain the basis of the division.
   (*b*) Why has Atikokan expanded to the north?
   (*c*) (i) Describe the railway facilities in Atikokan shown in the foreground of Photograph 4. (ii) Distinguish between the uses of the two types of railway rolling stock in the immediate foreground of the same photograph.
   (*d*) Atikokan is basically a one-industry town. What are the disadvantages inherent in such an economy?

7. List those features on the map which would suggest that forestry is an active part of this area's economy.

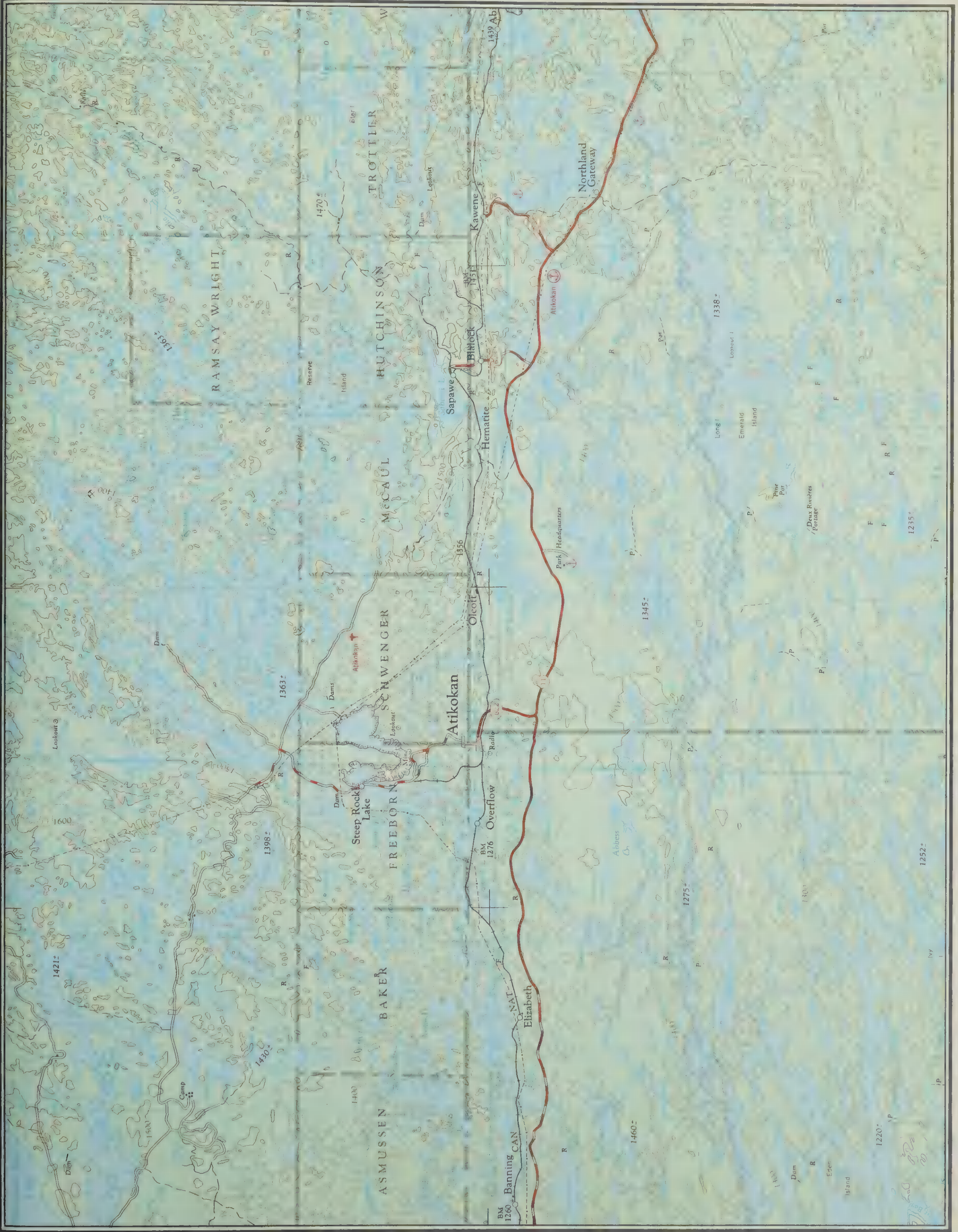
8. What forms of recreation are available for people in such a relatively remote area?

QUETICO 4



QUETICO ←

Scale 1: 250,000 C.I. 100′


RAMSAY WRIGHT
TROTTIER
HUTCHINSON
McCAUL
SCHWENGER
FREEBORN
BAKER
ASMUSSEN
Atikokan
Steep Rock Lake
Overflow
Elizabeth
Banning
CAN
NAT
Olcott
Hematite
Sapawe
Blalock
Kawene
Northland Gateway
Park Headquarters
Atikokan
Deux Rivieres Portage
Pine Por
Emerald Island
Long
Lookout
Lookout
Dam
Dams
Camp
Mine
Radio
Reserve
Island
Ivy
Eden
Island
BM 1260
BM 1276
1356
1451
1439 Ab
1470±
1363±
1363±
1398±
1421±
1430±
1460±
1345±
1338±
1275±
1252±
1235±
1220±
1600
1500
1400
1400 ft
BW
R
F
P

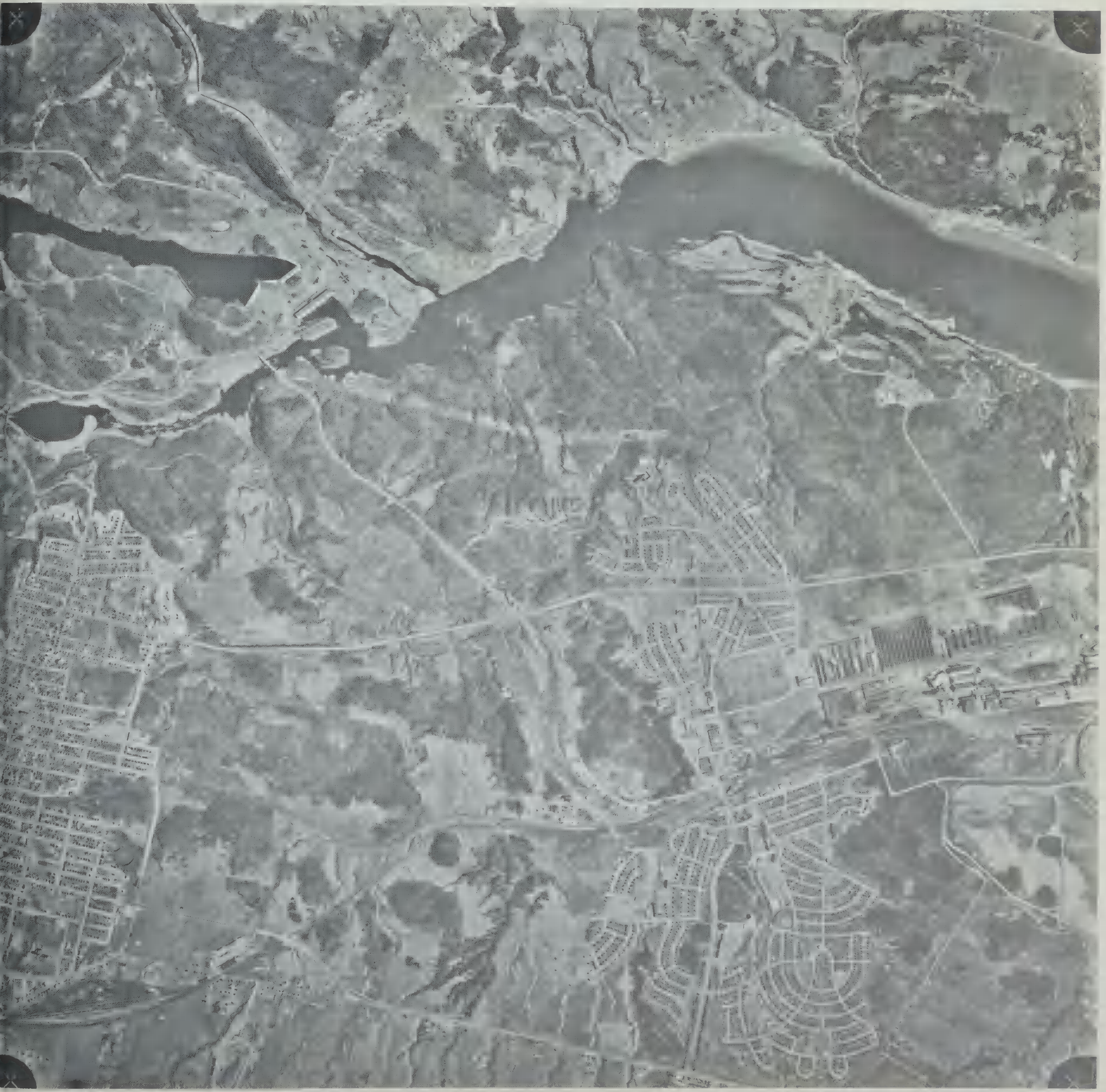
ARVIDA

This is an island of settlement within the Canadian Shield in Quebec. The city of Arvida is almost due north of Quebec City, and about three miles south-east of the point where the Saguenay River flows out of Lake St. John.

Assignment

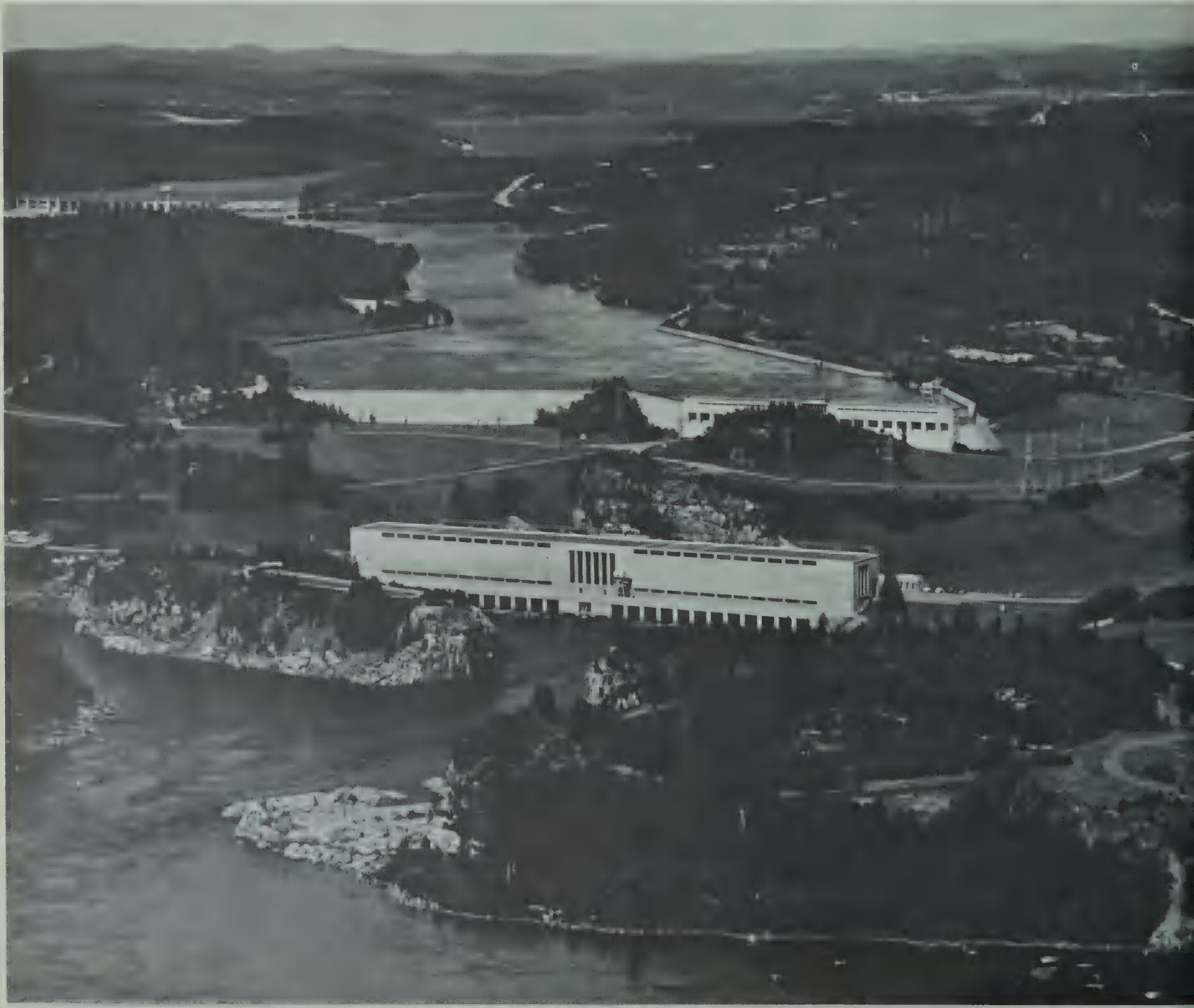
1. (*a*) Draw a profile of the Saguenay River from the large quarry on the north shore on Gridline 71 almost due north of St. Jean Eudes, to the Arvida Aluminum plant. Use a vertical scale of $\frac{1}{8}''$ to 50′.
   (*b*) From your profile account for the formation of the Saguenay valley.
2. (*a*) Where on the map do you find evidence of poor drainage? From your knowledge of the geological history of the Canadian Shield, suggest reasons for this condition.
   (*b*) What evidence is there of periodic diminishment of swamp conditions? At what time of year and for what reason would this occur?

ARVIDA 1



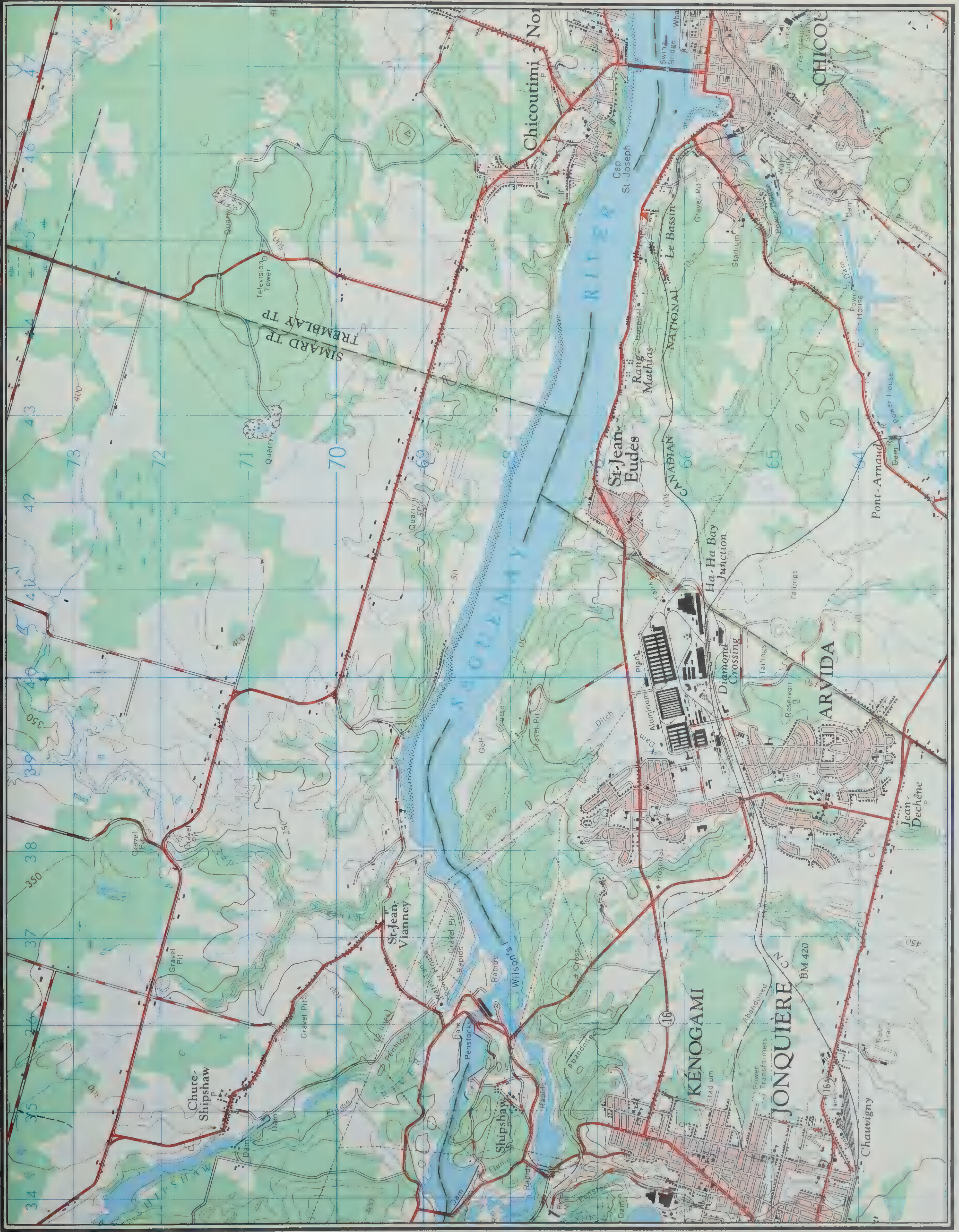
3. (*a*) At what heights are the two large stone quarries? Suggest a reason for this. Account for the shape of the hill between the two quarries.
   (*b*) Locate the four gravel pits in the region. Why are pits so plentiful in this area? State two uses to which they have been put.
4. Through how many feet does the Rivière des Vases drop between the gravel pit and the river mouth? What is the length of the river between these points? Determine its gradient.
5. What do you consider the major land use in this area: agriculture or forestry? What evidence on the map and photographs supports your choice?
6. What industry has the land use mentioned in question 5 probably given rise to? By reference to the map, is this industry more likely to be found in Arvida or Jonquière-Kénogami?
7. (*a*) What is the major industry in this area? Locate it on the map and one of the air photographs.
   (*b*) What is the chief type of power used in this industry? Find these power installations on Photographs 1 and 2 and on the map. From a study of these air photographs, why are power installations of this type easily built in this area?
   (*c*) What is meant by a penstock? Why are they necessary? Locate on the vertical air photograph the penstock leading from Chute-Shipshaw to the Saguenay River.
   (*d*) Why was the Shipshaw River developed for power and not the Rivière des Vases? How is the power transmitted from the Shipshaw developments to the consumers? Locate these lines on the map and Photographs 1 and 2.
   (*e*) What is the function of the two dams near Chute-Shipshaw?

ARVIDA 2



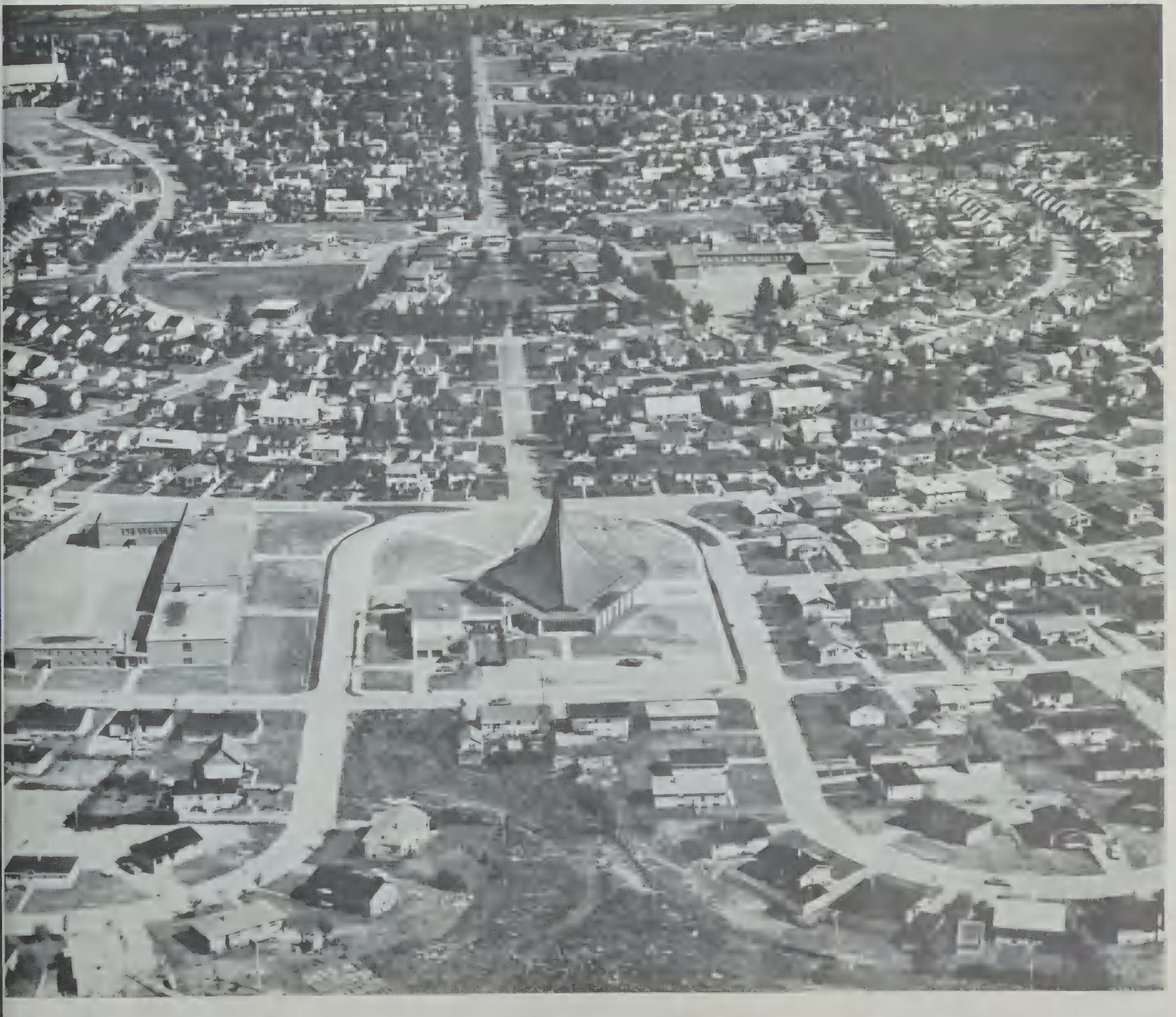
ARVIDA ←

Scale 1: 50,000


Chicoutimi
Nor
CHICOU
Swing Bridge
Whar
Arena
Transformer Station
Cap St-Joseph
Le Bassin
Gravel Pit
Stadium
Penstock
Power House
Dam
Abandoned
Television Tower
Quarry
TREMBLAY TP
SIMARD TP
RIVER
SAGUENAY
Hospital
Rang Mathias
NATIONAL
CANADIAN
St-Jean-Eudes
Ha-Ha Bay Junction
Tailings
Pont-Arnaud
Power House
Aluminum Plant
Diamond Crossing
Reservoir
ARVIDA
Golf Course
Gravel Pit
Ditch
Dam
Jean-Dechêne
Hospital
St-Jean-Vianney
Rapids
Wilson's I
Power House
Penstock
Flume
Shipshaw
Chute-Shipshaw
SHIPSHAW
KÉNOGAMI
Stadium
JONQUIÈRE
BM 420
Power Transformers
Abandoned
Race Track
Chauvigny
16
34
35
36
37
38
39
40
41
42
43
44
45
46
47
64
65
66
69
70
71
72
73
400
350
250
200
150
50

8. (*a*) What is the main raw material in the aluminum industry?
   (*b*) This raw material used to be imported at Chicoutimi, the city in the south-east corner of the map. How did the raw material reach the plant?
   (*c*) Why did the site of this city offer better location for a port than any other?
   (*d*) Suggest reasons why Chicoutimi is no longer used for importing the raw material.
9. (*a*) At what height is the aluminum plant located?
   (*b*) Why was this particular site chosen for the plant?
   (*c*) Is the city of Arvida likely to expand north and west? Justify your decision by reference to the map and the vertical air photograph. In which direction is Arvida likely to expand? Why?
10. (*a*) Identify the two population centres shown on the vertical air photograph. Which centre has the characteristics of a modern planned town? Give examples.
   (*b*) List some advantages and disadvantages of a planned town.
   (*c*) Find the area shown on Photograph 3 on the map. In which direction was Photograph 3 taken? Aside from residential land use, identify four other types of land use shown.

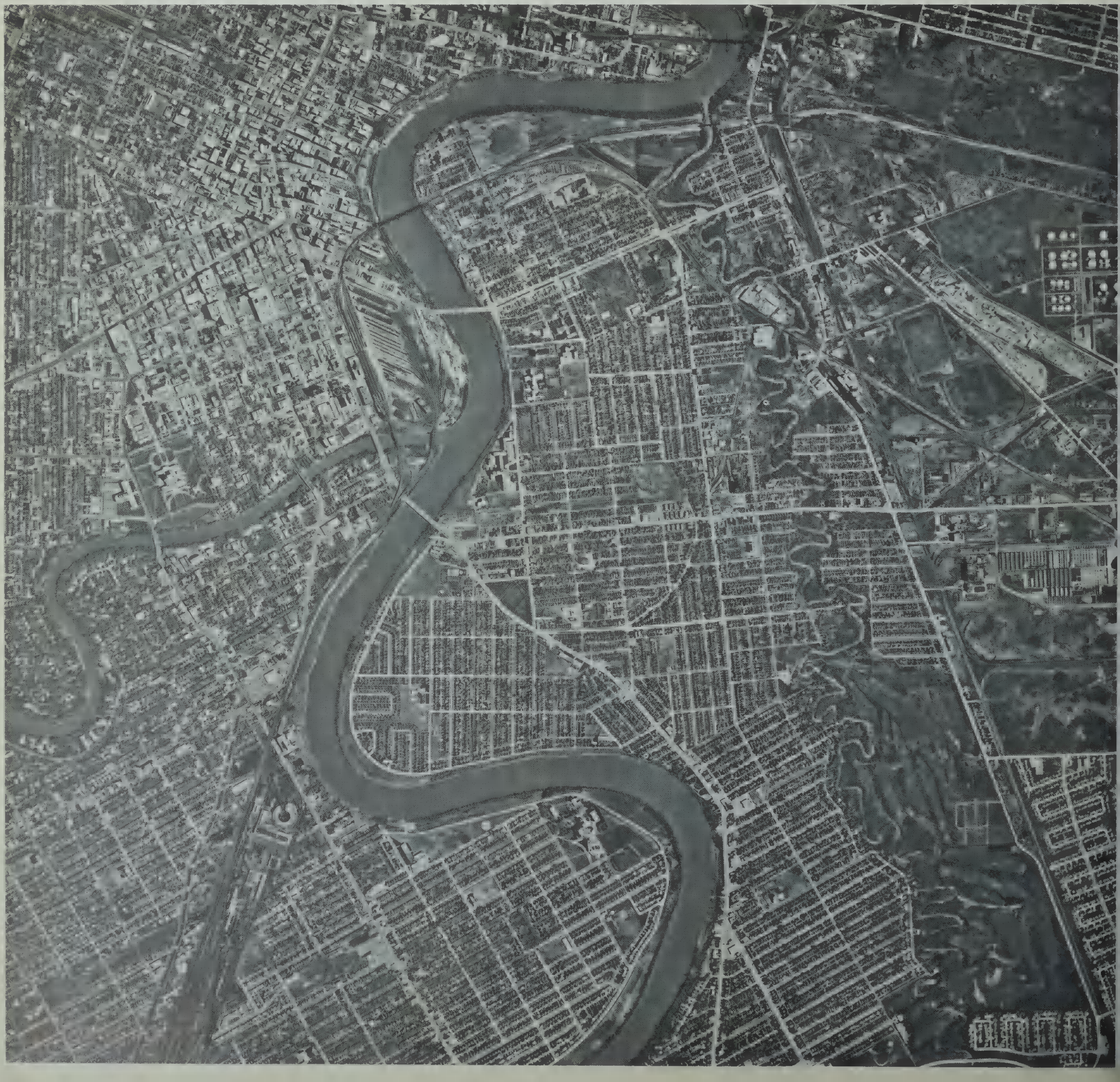
ARVIDA 3



WINNIPEG

Winnipeg is the oldest city west of Ontario and the largest city between Toronto and Vancouver. Fort Garry, the original site of the city, is just to the north of the junction of the Assiniboine and Red Rivers. On the map the Assiniboine flows from the west, and the Red River from the south. A small river, the Seine, enters the Red River downstream from the confluence of the Red and Assiniboine Rivers.

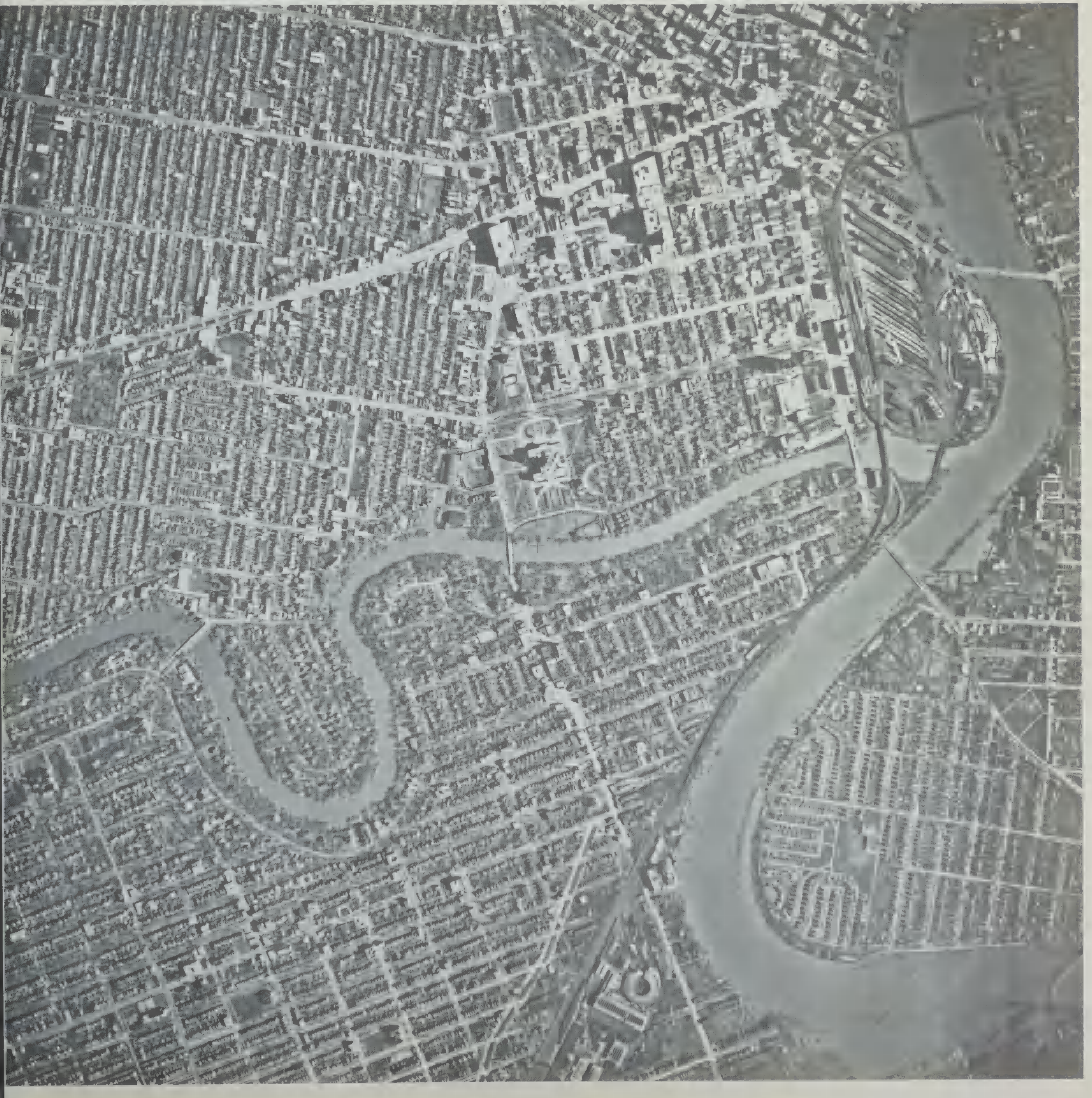
WINNIPEG 1



Assignment

1. (*a*) Does the map or the plan cover the greater area of ground?
   (*b*) Find the square mile area covered by each.
   (*c*) As the Representative Fraction of the map (R.F.) is 1:50,000, how many inches on the ground are shown by one inch on the map?
2. (*a*) What does the winding or meandering of the rivers, and the absence of contours on the map, suggest about the land over which the rivers flow?
   (*b*) Find other evidence to support your conclusion to part (*a*) of the question. What are the advantages and disadvantages of this type of topography?
   (*c*) What is the significance of the 750′ depression contour east of the Red River on the town plan? How is much of this land used today? Study Photograph 1 and the town plan. How does the street pattern conform in part to the depression?
3. (*a*) How does the map suggest that flooding could be a major problem? You are reminded that the Red River flows from the south to the north. Study Photographs

WINNIPEG 2



1 and 2. What evidence is there that Photograph 2 was taken during a period of flooding?

(*b*) Find on the town plan the area in the lower right hand corner of Photograph 2. How high would the river have to rise to flood this area? Refer to the town plan and state how the area is protected against flooding. Locate on the town plan three other main areas of flooding on Photograph 2.

(*c*) Describe in some detail other methods of flood control shown on the map and town plan.

(*d*) Why would the construction of flood control dams be difficult in this area?

4. (*a*) The original site of Fort Garry was on the left bank of the Red River just north of the confluence with the Assiniboine. What advantages did this site afford early transportation?

(*b*) How is the Central Business District shown on the plan? Name the two main streets that traverse this district. Find these streets on Photograph 2.

(*c*) What early trade routes are indicated by these roads?

5. (*a*) "Created by the railways, Winnipeg is also dominated by them."[1] Draw a sketch map of the city centre and on it show to what extent this quotation is true by indicating the main marshalling yards and railway lines. Suggest possible destinations for the main lines.

(*b*) Winnipeg has a population of over 500,000, Montreal 2,000,000 and Vancouver 650,000. Compare the number of railway yards in Winnipeg with those in Montreal and Vancouver.

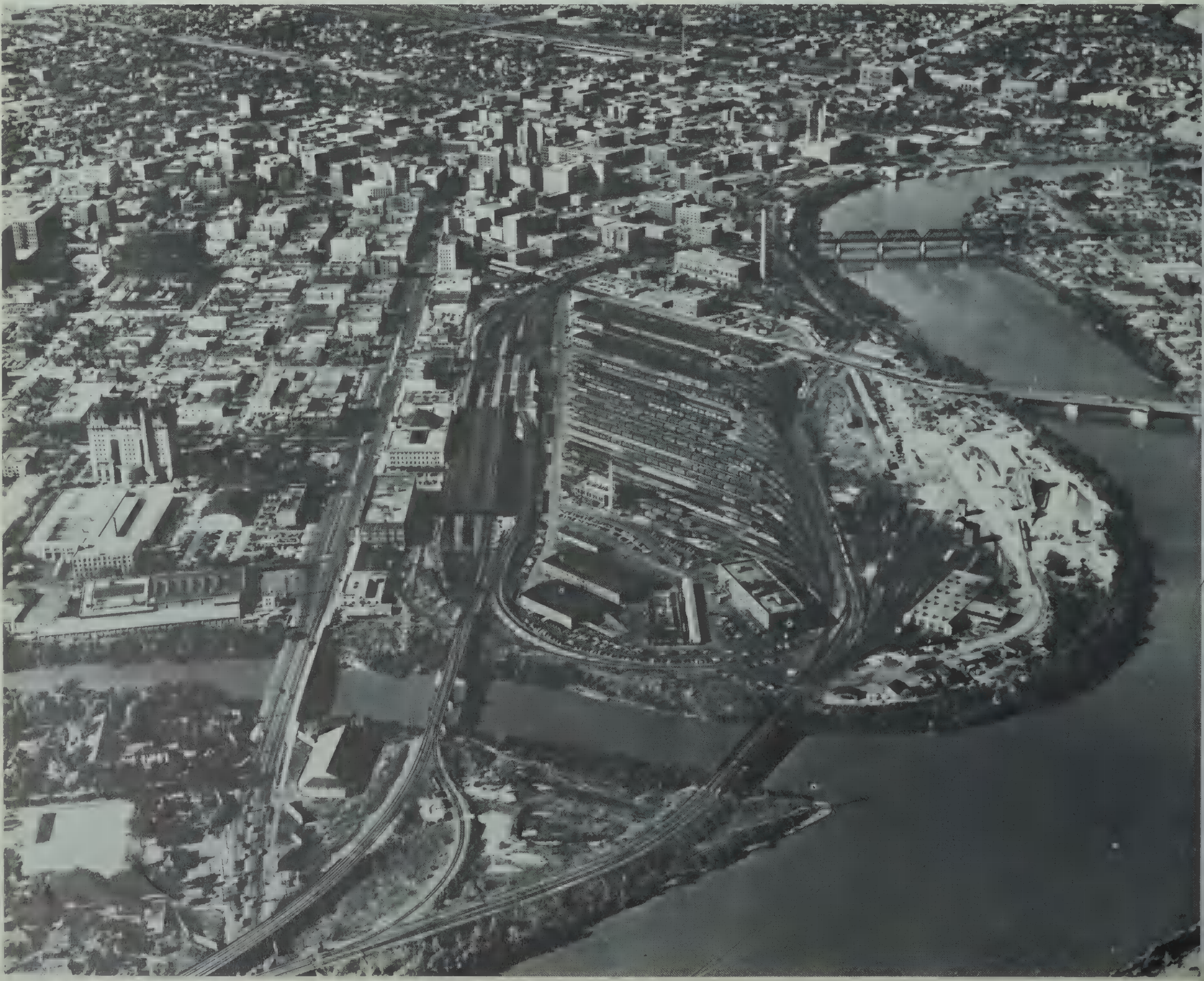
(*c*) What does this large number of railway yards indicate about the chief function of the city?

(*d*) Find evidence that shows the nature of western products flowing east through Winnipeg. Study the map, town plan and Photograph 1.

---

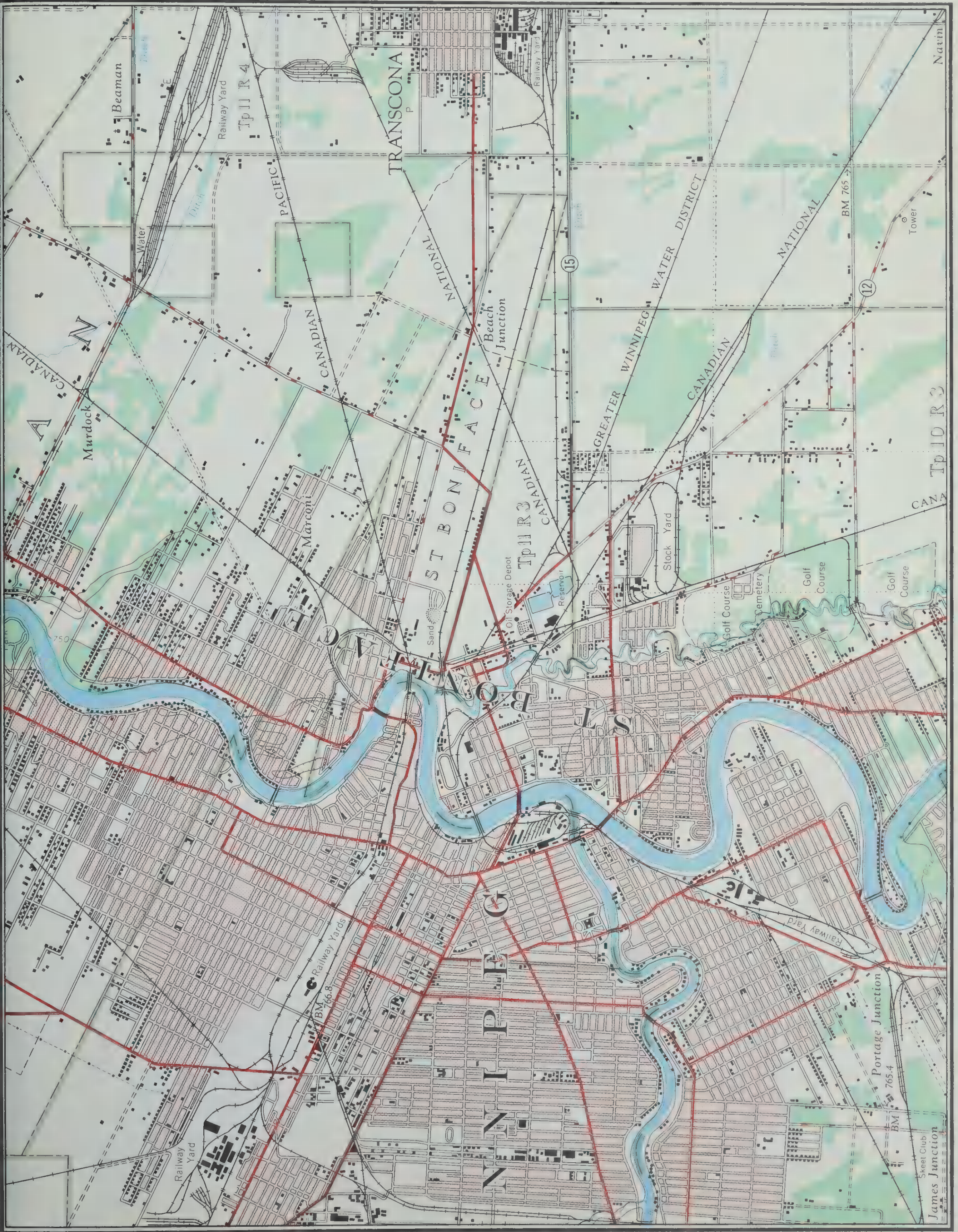
[1] Putnam, D., Canadian Regions, (Dent, 1952), p. 394.

WINNIPEG 3



WINNIPEG ←

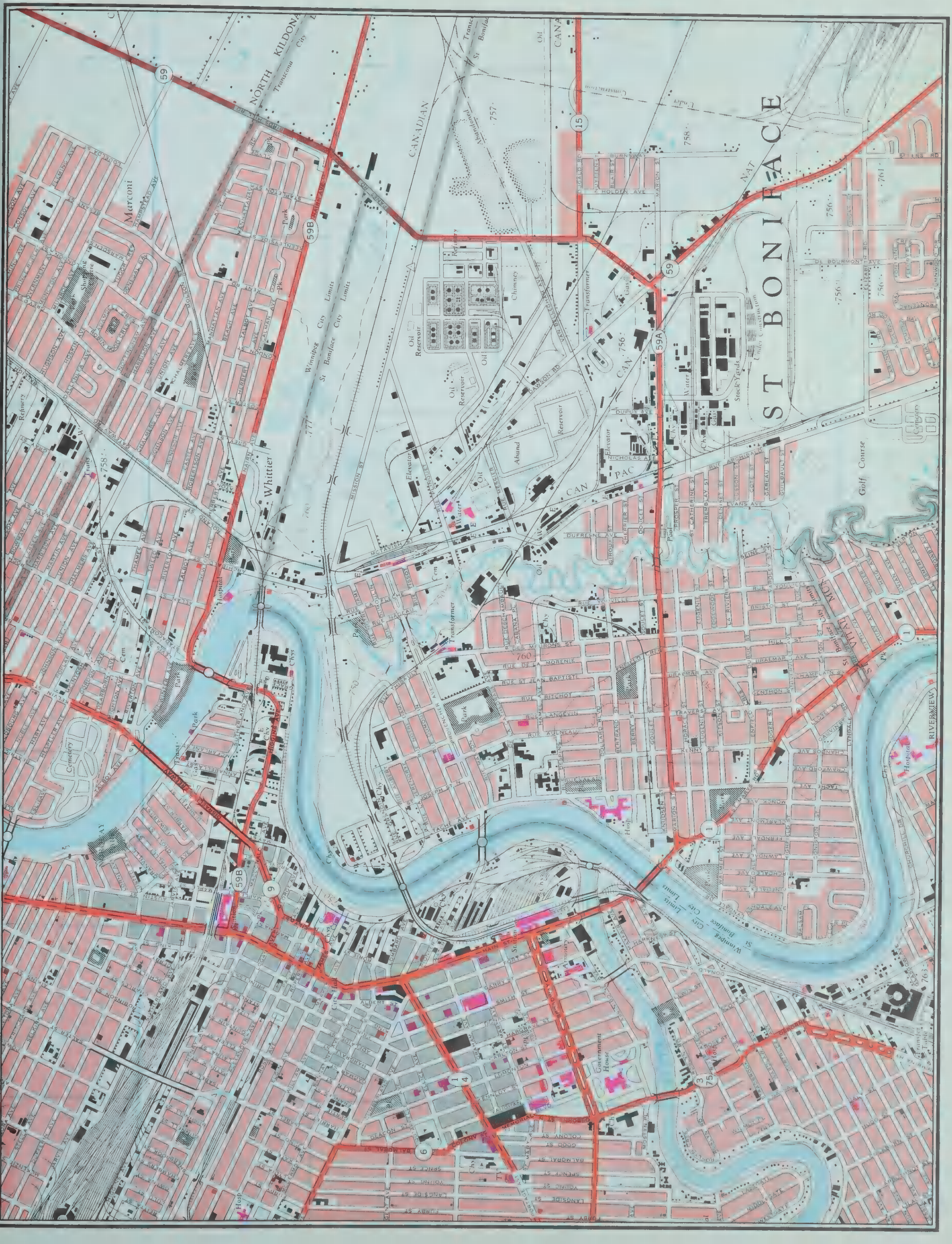
Scale 1: 50,000 C.I. 25′



Beaman
Railway Yard
Tp 11 R 4
TRANSCONA
Railway Yard
Navin
Water
PACIFIC
CANADIAN
NATIONAL
Beach Junction
GREATER WINNIPEG WATER DISTRICT
NATIONAL
BM 765
Tower
15
12
CANADIAN
CANADIAN
N
A
Murdock
Marconi
ST BONIFACE
Tp 11 R 3
CANADIAN
Tp 10 R 3
CANA
Oil Storage Depot
Reservoir
Stock Yard
Sand
Golf Course
Cemetery
Golf Course
Golf Course
750
WINNIPEG
Railway Yards
BM 766.8
Railway Yard
Railway Yard
Portage Junction
BM 765.4
Skeet Club
James Junction

WINNIPEG TOWN PLAN ←

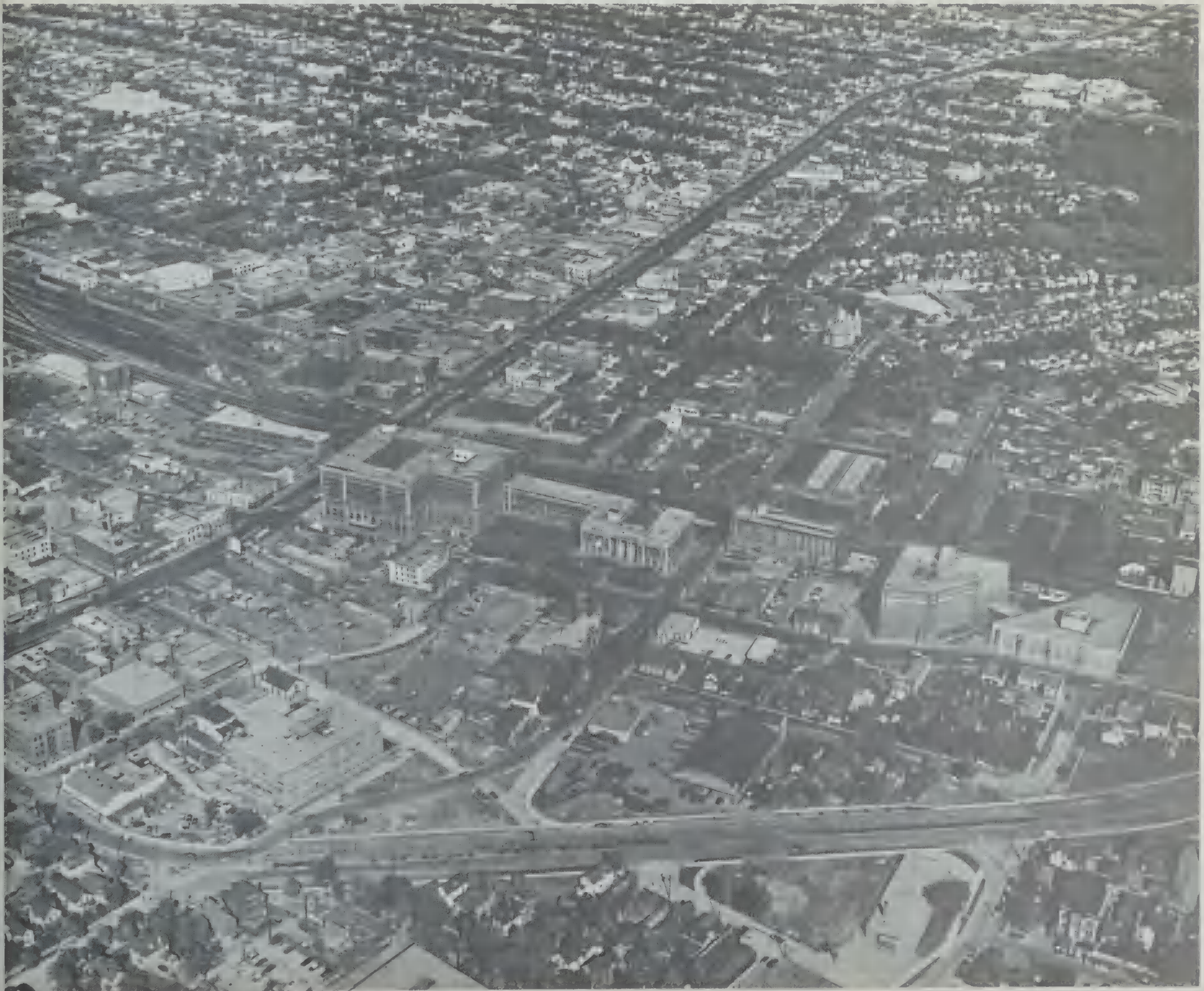
Scale 1: 25,000 C.I. 10′


59
NORTH KILDONAN
Transcona
CANADIAN
Abandoned
757
15
ST BONIFACE
758
NAT
Marconi
59B
Park
Winnipeg City Limits
St Boniface City Limits
Refinery
Oil Reservoir
Chimney
Transformer
59
59A
DAWSON RD
Reservoir
Aband
Water
Stock Yards
Under Construction
756
DE BOURMONT AVE
Golf Course
Elevator
CAN PAC
DUFRESNE AVE
DUPUY AVE
NICHOLAS AVE
Whittier
Refinery
758
MISSION ST
MCTAVISH ST
Cem
Hospital
Park
Cemetery
760
RUE DES MEURONS ST
RUE DE LA MORENIE
RUE ST JEAN BAPTISTE
RUE RITCHOT
RUE LANGEVIN
RUE AULNEAU
PROSPER ST
DUFFERIN
EVANS AVE
HILL ST
BRAEMAR AVE
CHAMPLAIN ST
TRAVERS ST
KENNY ST
TACHE AVE
1
RIVERVIEW
Hospital
Hosp
9
59B
MAIN ST
Station
ALBERT
Winnipeg City Limits
St Boniface City Limits
Government House
Armoury
1
4
3
75
6
MEMORIAL BLVD
COLONY ST
BALMORAL ST
SPENCE ST
YOUNG ST
LANGSIDE ST
FURBY ST
DEACON
ST MARY'S
763

6. Winnipeg is a good example of the concentric arrangement of land uses found in cities that develop on open plains. Find the areas shown on Photographs 3 and 4 on the town plan. The railway yard shown in the left centre of Photograph 4 appears in the northwest corner of the town plan.
   (*a*) Beginning with the Central Business District, write a note describing this concentric zonation of land uses. Compare this type of development with that which occurred in the early history of Montreal. Refer to all four photographs, the town plan and the map.
   (*b*) List the activities found in the industrial zones.
   (*c*) What indications are there that the suburban development east of Gateway Road is a more modern suburban development than that west of Gateway Road?
   (*d*) What other human and economic activities are evident from the map and town plan?

7. (*a*) What fact is suggested by some street names on the right bank of the Red River?
   (*b*) Describe the street pattern of Winnipeg as shown on the map and town plan.
   (*c*) How has the relief of the area facilitated construction of this street pattern?
   (*d*) What advantages are offered by a such a street pattern?

WINNIPEG 4



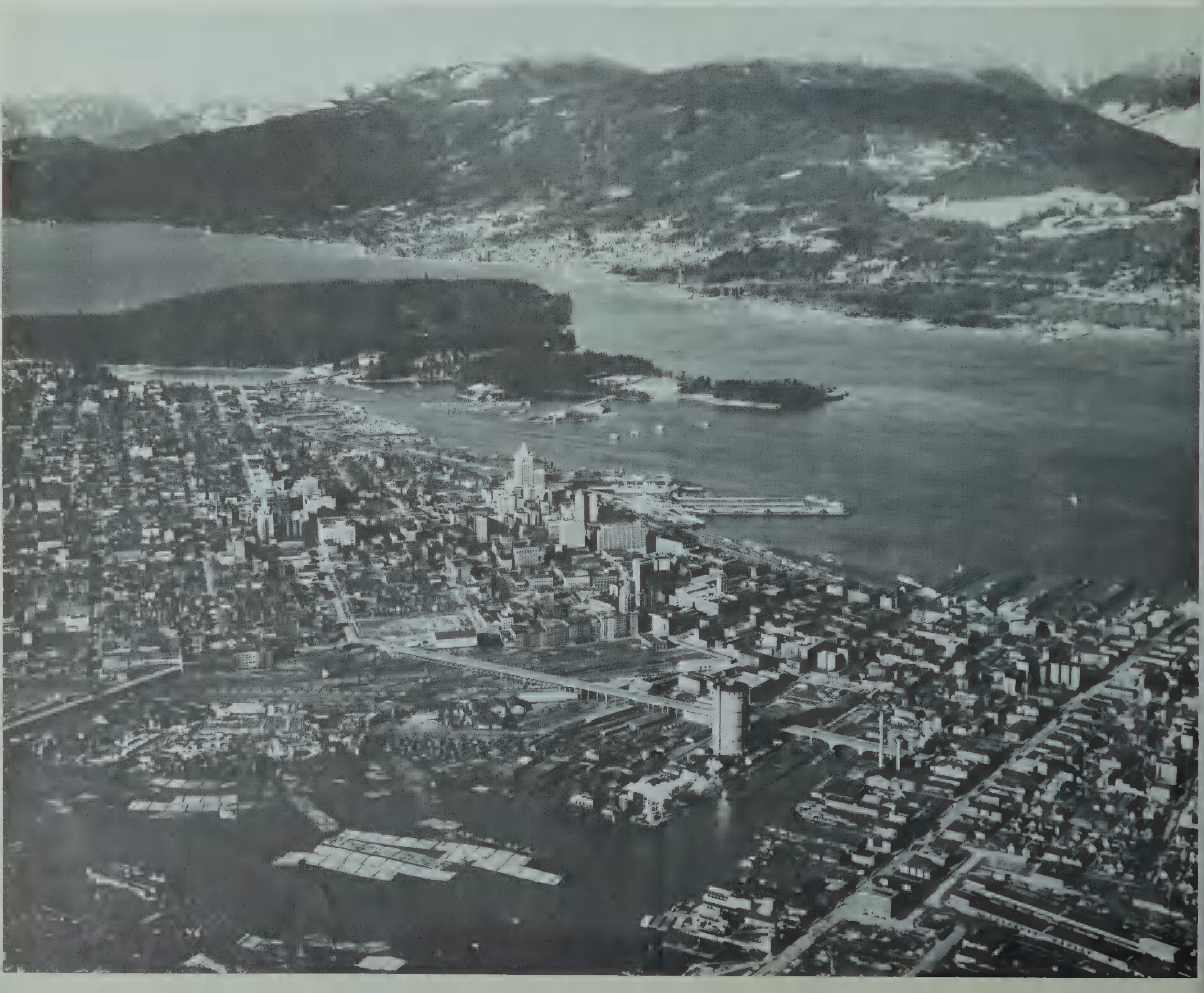
VANCOUVER

Most of Vancouver lies between Burrard Inlet and the mouth of the Fraser River. This part of the city is built on rolling upland between sea level and 200′, except in the area of Mount Burnaby which is about 1,200′ high. The city began on a series of silt and till ridges about 120′ high between False Creek and Burrard Inlet. In the Central Business District these ridges run generally east-west, terminating in the northwest in Stanley Park.

Assignment

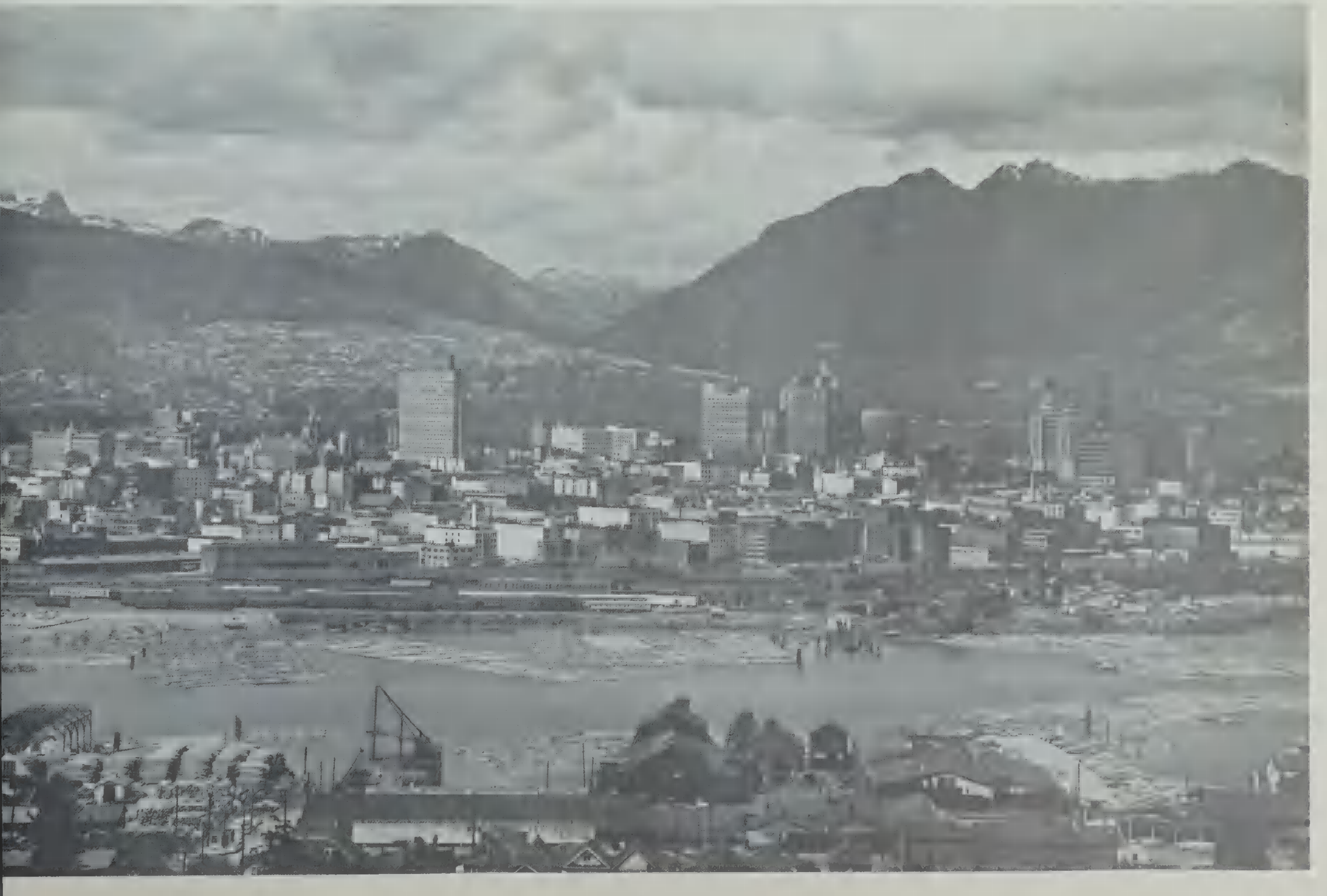
1. Referring to Highway 99B on the town plan, find the distance between False Creek and Burrard Inlet.
2. Which shows the most extensive area; the map, the plan or Photograph 1? Which shows the least extensive area?
3. Study the map and Photographs 1 and 2 and find evidence of alpine glaciation in the region.

VANCOUVER 1



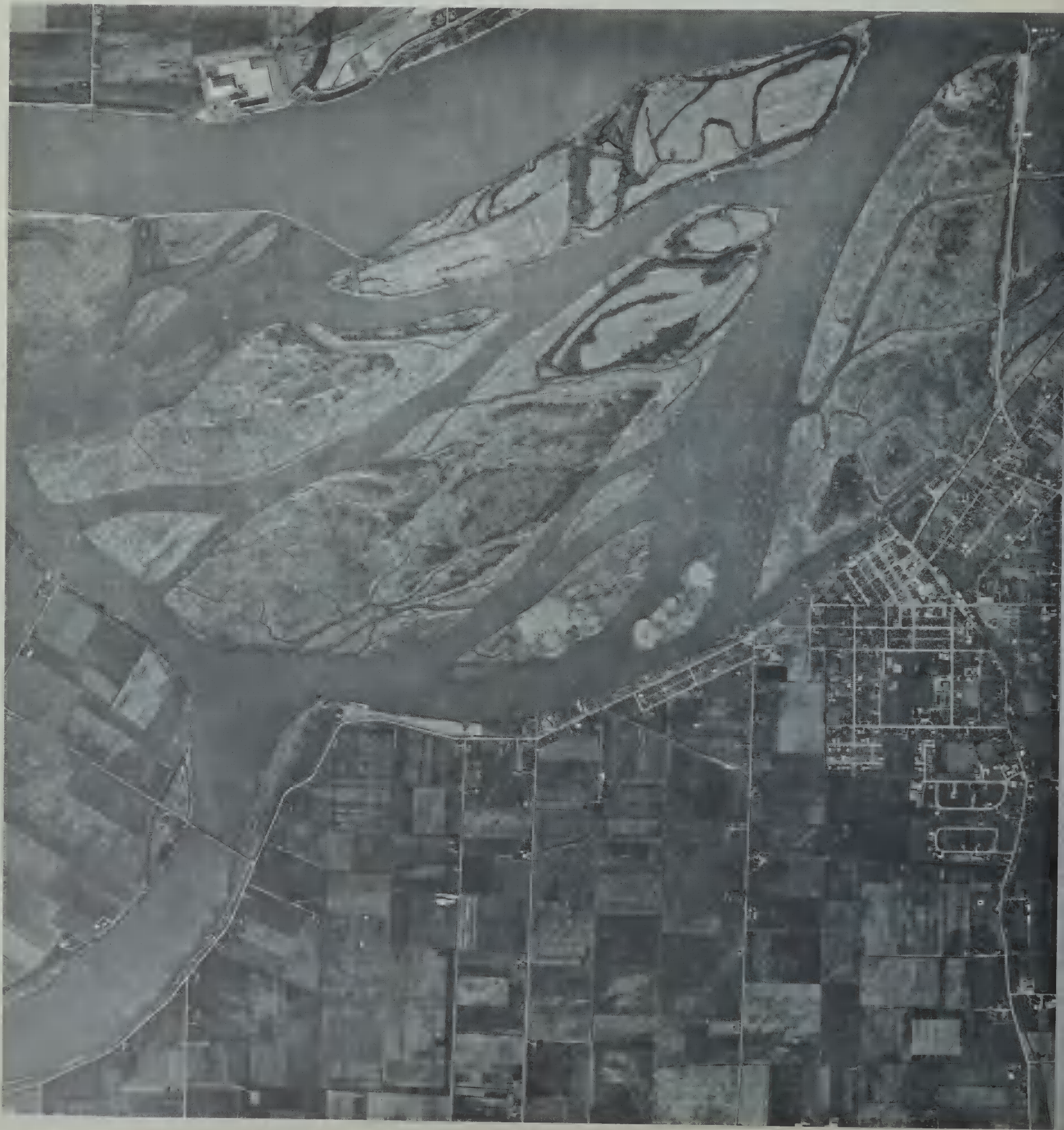
4. Divide the map into two physical regions and describe and account for the main features of each. Give examples. Refer to Photographs 2 and 3.
5. How does the pattern of relief suggest that folding occurred in the highland area?
6. List as many features as possible of high precipitation in the area shown on the map and on Photographs 1 and 2.
7. What types of natural vegetation would have occurred in this area at one time? Study the map and Photographs 1 and 2.
8. (*a*) In what region of the map will agriculture be most important?
    (*b*) Study Photograph 3 and locate it on the map. What attributes will the soil in this region possess?
    (*c*) What will be the dominant agricultural activities? Suggest reasons for their importance.
    (*d*) Name the island in the centre of Photograph 3. What indications are there that drainage is an agricultural problem?
9. (*a*) What physical attributes have combined to make Vancouver Canada's major west coast port? Refer to the map and Photographs 1 and 2.

VANCOUVER 2



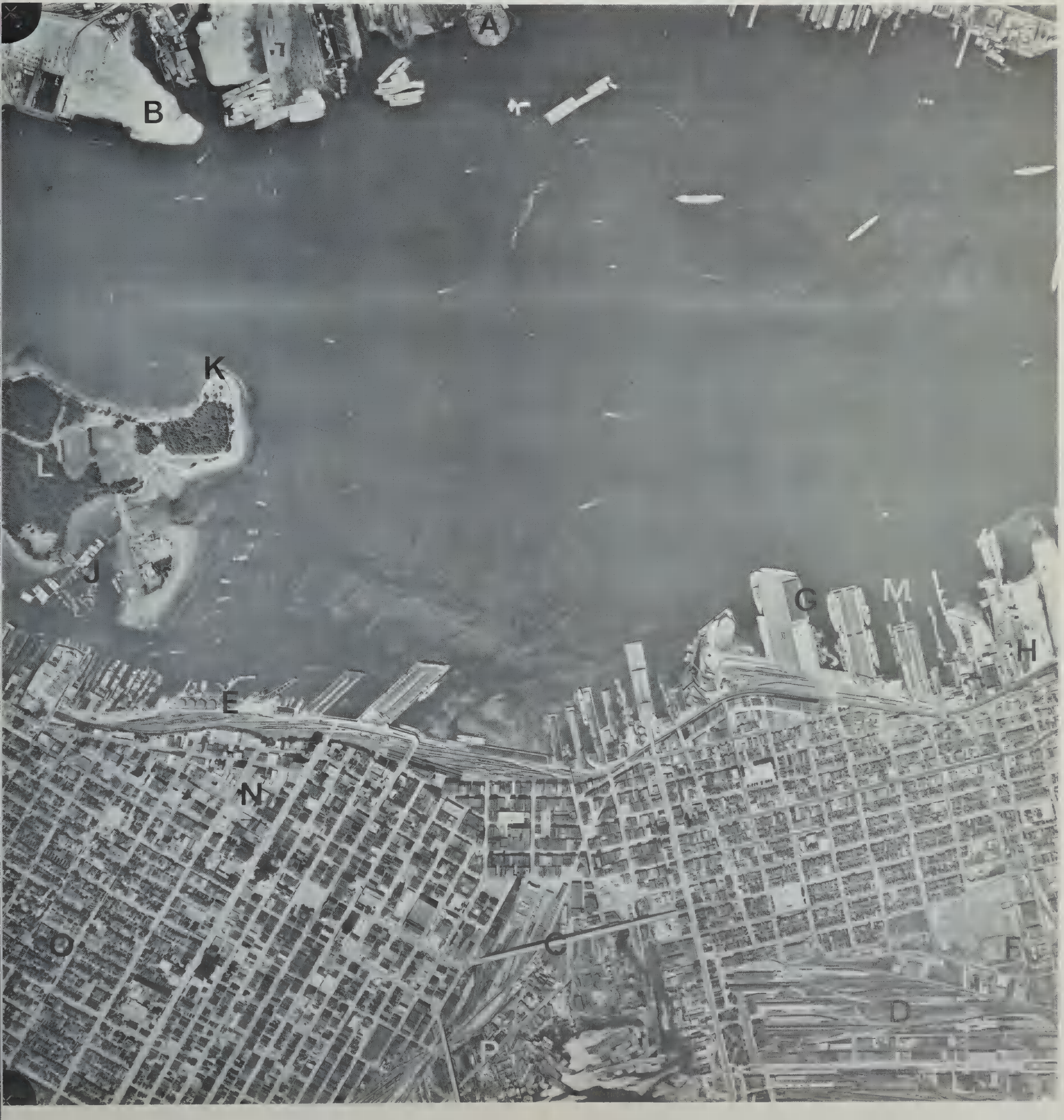
(*b*) Locate the major dock area on the plan and photographs. Find this same area on the map. Why did the port develop here rather than on False Creek or the Fraser River? Find False Creek on Photograph 1 and the town plan.

VANCOUVER 3



10. (*a*) In which direction was Photograph 2 taken? Identify the body of water in the centre foreground.
    (*b*) List the land uses in the immediate foreground of the picture and on the north shore.
    (*c*) Locate this same body of water and these land uses on Photograph 1. Locate on Photograph 1 the Georgia Street viaduct shown on the town plan.

VANCOUVER 4



(*d*) Identify the land uses north of the viaduct on Photograph 1 up to Burrard Inlet.

(*e*) Find on the town plan and on Photograph 1 the dock area shown on Photograph 5. Identify the main types of vessels shown on Photograph 5.

(*f*) From a study of Photograph 6 identify three main products handled by the port of Vancouver.

11. (*a*) From your study of the town plan and the aerial photographs outline on a sketch map the functional zones between Burrard Inlet and the south shore of False Creek.

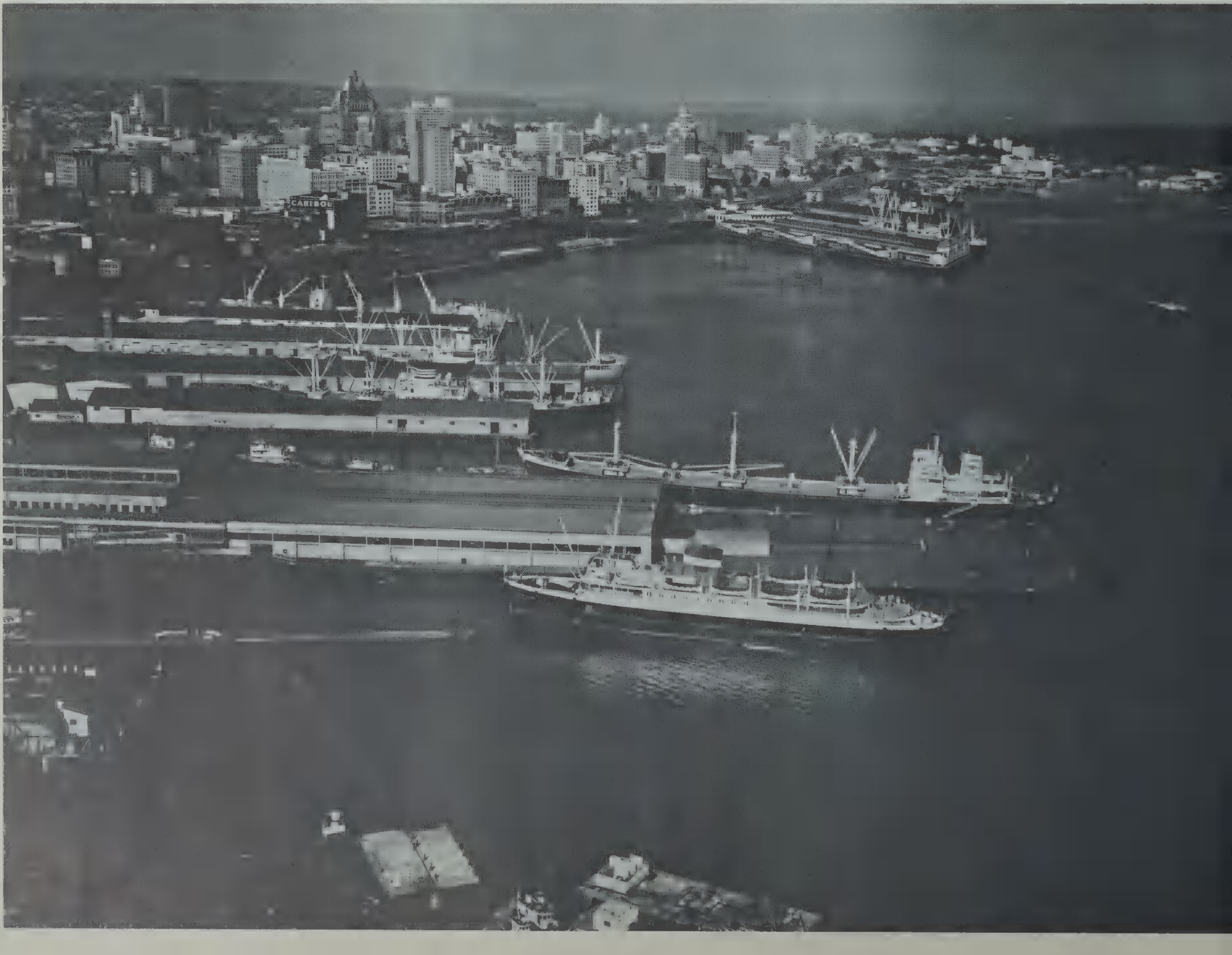
(*b*) From a study of the town plan, map, and photographs deduce as many industrial and commercial activities as you can.

(*c*) Where is most industry concentrated? What advantages does this area possess?

(*d*) Identify the features and or land uses shown by the letters A to P on Photograph 4.

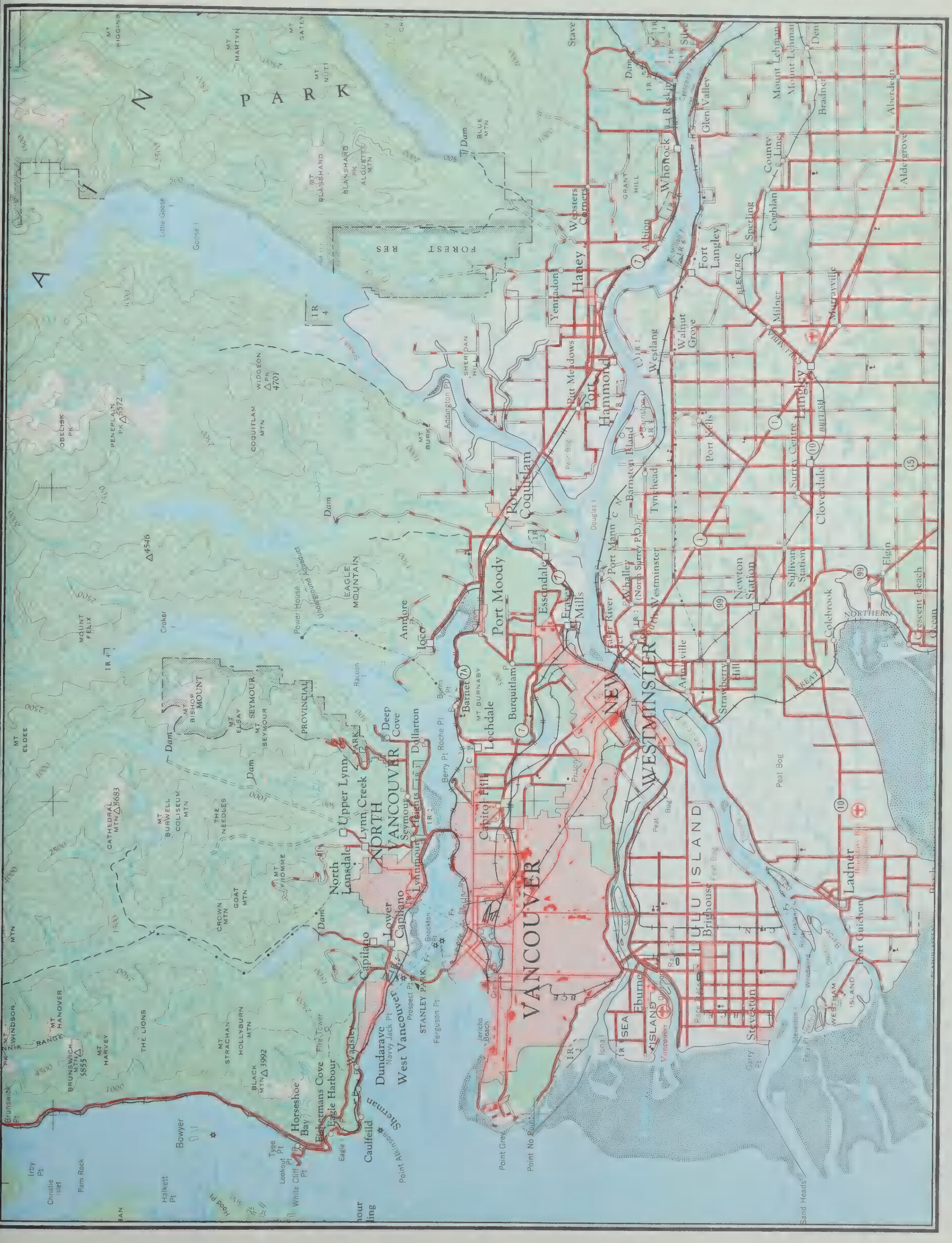
12. (*a*) From a study of the map, list those forms of transportation that meet in the greater Vancouver area. As a result of this, what transportation function is performed by the city?

VANCOUVER 5



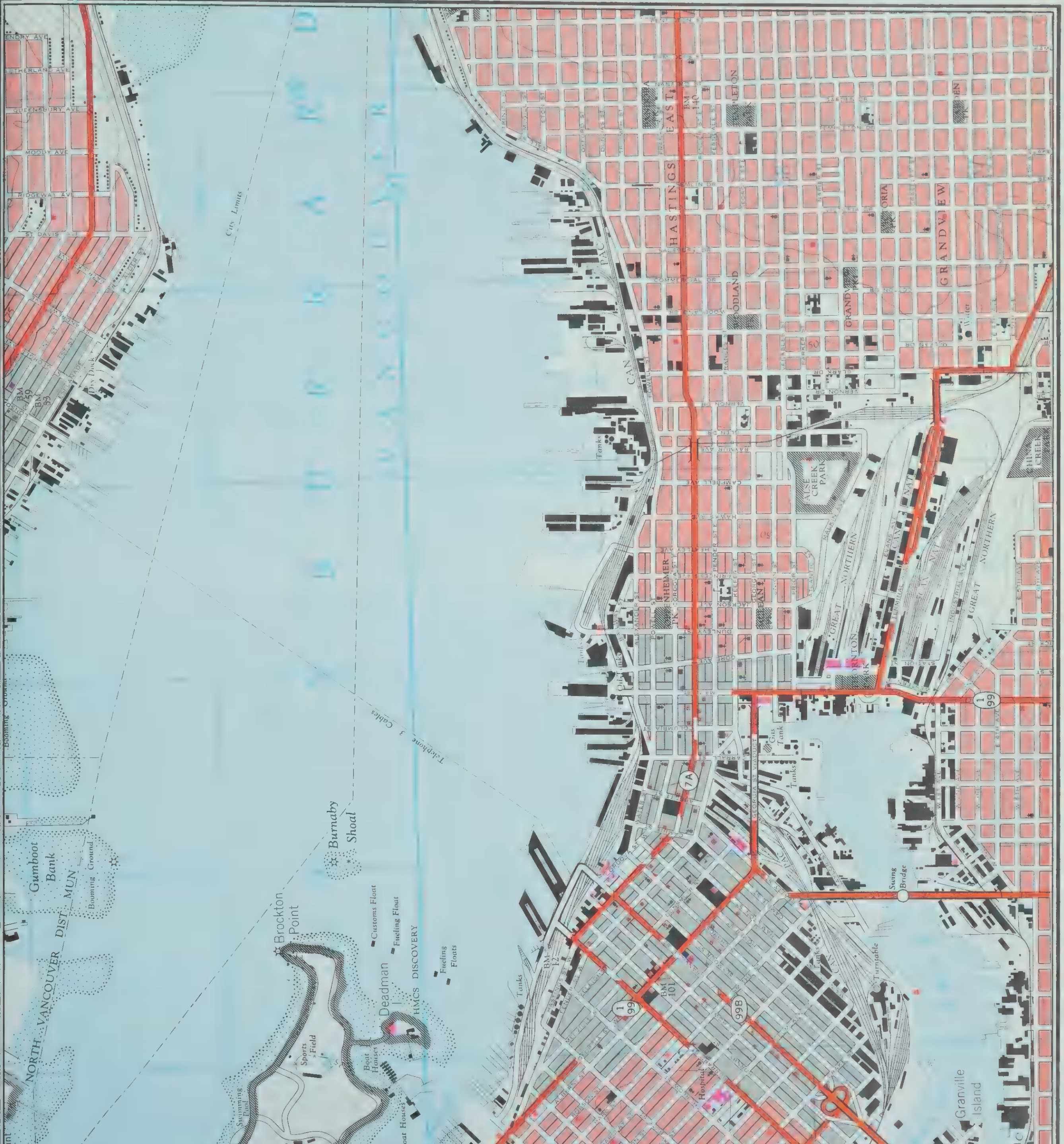
VANCOUVER ←

Scale 1: 250,000


VANCOUVER
NORTH VANCOUVER
NEW WESTMINSTER
West Vancouver
STANLEY PARK
LULU ISLAND
SEA ISLAND
PARK
PROVINCIAL PARK
FOREST RES
Horseshoe Bay
Caulfeild
Dundarave
Capilano
Lower Capilano
North Lonsdale
Lynn Creek
Upper Lynn
Deep Cove
Dollarton
Barnet
Lochdale
Capitol Hill
Burquitlam
Port Moody
Ioco
Anmore
Port Coquitlam
Essondale
Fraser Mills
Port Hammond
Pitt Meadows
Haney
Yennadon
Websters Corners
Whonock
Ruskin
Albion
Fort Langley
Glen Valley
Walnut Grove
Milner
Murrayville
Langley
Aldergrove
County Line
Coghlan
Sperling
Bradner
Mount Lehman
Aberdeen
Port Kells
Surrey Centre
Cloverdale
Tynehead
Barnston Island
Port Mann
Whalley
Westminster
Annieville
Strawberry Hill
Newton Station
Sullivan Station
Colebrook
Elgin
Crescent Beach
Ladner
Port Guichon
Brighouse
Steveston
Eburne
Westham Island
Point Grey
Point No Point
Point Atkinson
Eagle Harbour
Fishermans Cove
Whytecliff Pt
Bowyer I
Pam Rock
Christie Islet
Irby Pt
Halkett Pt
Sand Heads
MT SEYMOUR
MT BURNABY
COQUITLAM MTN
EAGLE MOUNTAIN
CATHEDRAL MTN 5683
BLACK MTN 3992
BRUNSWICK MTN 5855
MT HARVEY
THE LIONS
MT STRACHAN
HOLLYBURN MTN
CROWN MTN
GOAT MTN
MT FROMME
THE NEEDLES
COLISEUM MTN
MT BURWELL
MOUNT FELIX
PENEPLAIN PK 5572
OBELISK PK
WIDGEON PK 4701
BLANSHARD PK
ALOUETTE MTN
MT BLANSHARD
BLUE MTN
MT BURKE
GRANT HILL
SHERIDAN HILL
Peat Bog
Underground Aqueduct
Power House
Dam
IR
7
7A
1
10
15
99

VANCOUVER TOWN PLAN

← Scale 1: 25,000


HASTINGS EAST
GRANDVIEW
WOODLAND
GREAT NORTHERN
CAN. NAT.
CAN. PAC.
City Limits
Telephone 3 Cables
Burnaby Shoal
Gumboot Bank
Booming Ground
NORTH VANCOUVER DIST. MUN.
Brockton Point
Customs Float
Fueling Float
Fueling Floats
HMCS DISCOVERY
Deadman I.
Sports Field
Swimming Pool
Boat Houses
Zoo
Fountain
Calamity Point
LEY
RK
Tanks
Gas Tank
Hospital
Armoury
WEST END
ENGLISH BAY PARK
SUNSET BEACH PARK
Granville Island
Swing Bridge
Turntable
7A
1
99
99B

(*b*) Give the location of Vancouver airport as shown on the map. What advantages does this site offer?

(*c*) Using the map, describe the routes followed by the Canadian railways coming into Vancouver from the east.

13. (*a*) From the map, how many bridges connect central Vancouver to the mainland north of Burrard Inlet? What areas are linked by the bridge shown on Photograph 1? What type of bridge is it? Why was this type utilised?

(*b*) How has the construction of these bridges influenced urban expansion? Study the background of Photographs 1 and 2 and the map.

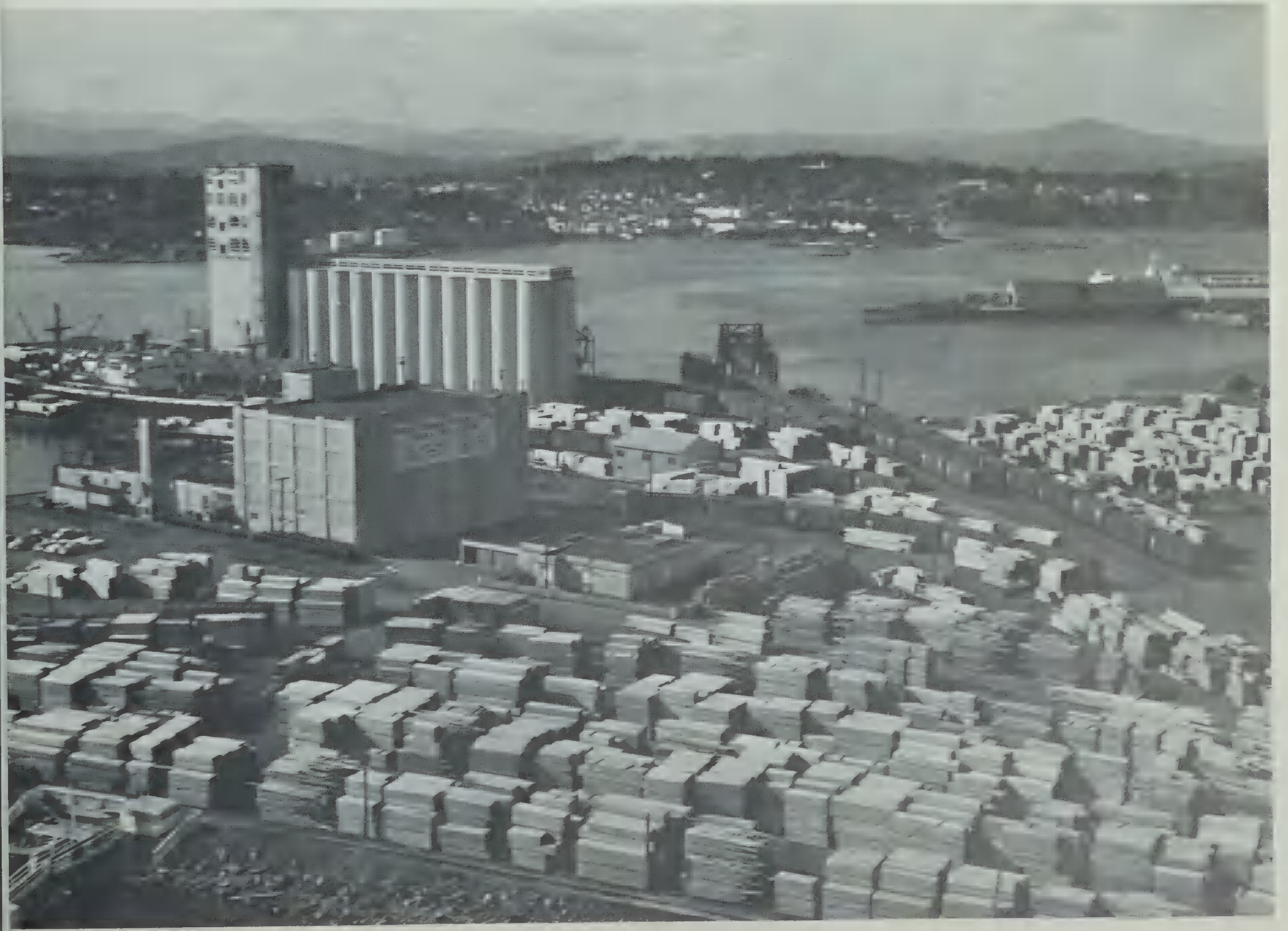
(*c*) Why is expansion in this direction preferred to expansion in the south?

(*d*) What factors will limit the expansion of the city? What difficulties would be experienced, particularly during rush hours, by a resident living in North or West Vancouver and working in Vancouver proper?

14. Find on the map two sources of power and water for Greater Vancouver.

15. Refer to the Montreal map and discuss the similarities between that city and Vancouver with reference to site, economy, functions, and urban growth.

VANCOUVER 6



TORONTO

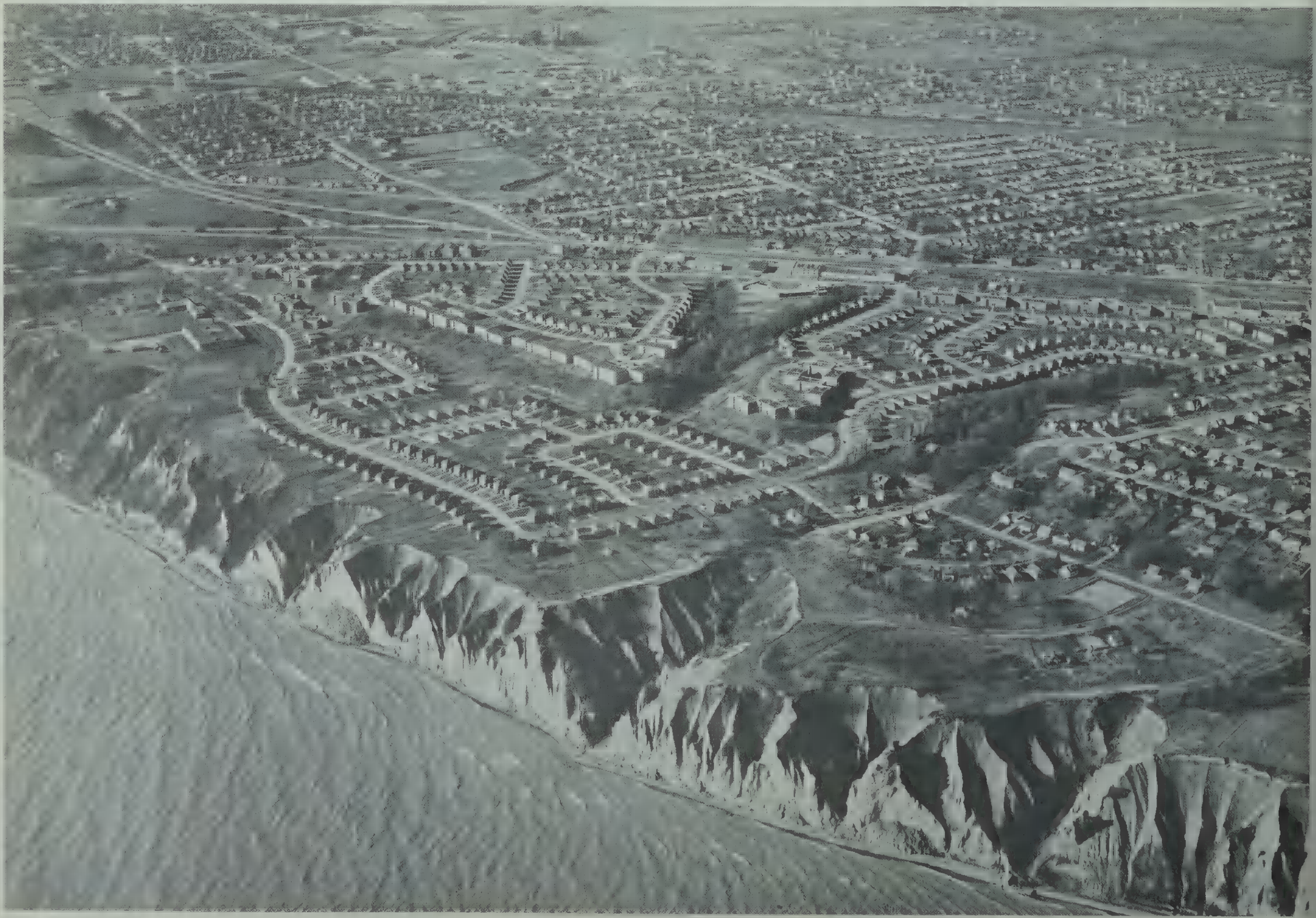
Toronto is on the north shore of Lake Ontario, which is 246 feet above sea level. Two rivers, the Don and the Humber, flow through the city and empty into Lake Ontario.

As may be seen from the place name the northern edge of the map is part of the Oak Ridges or Interlobate Moraine. The western edge of the map is part of the Niagara Escarpment. East of the Niagara Escarpment and south of the Interlobate Moraine is an area of predominantly glacial till and drumlins interspersed with clays from post-glacial lakes, as for example the Brampton clay plain.

Assignment

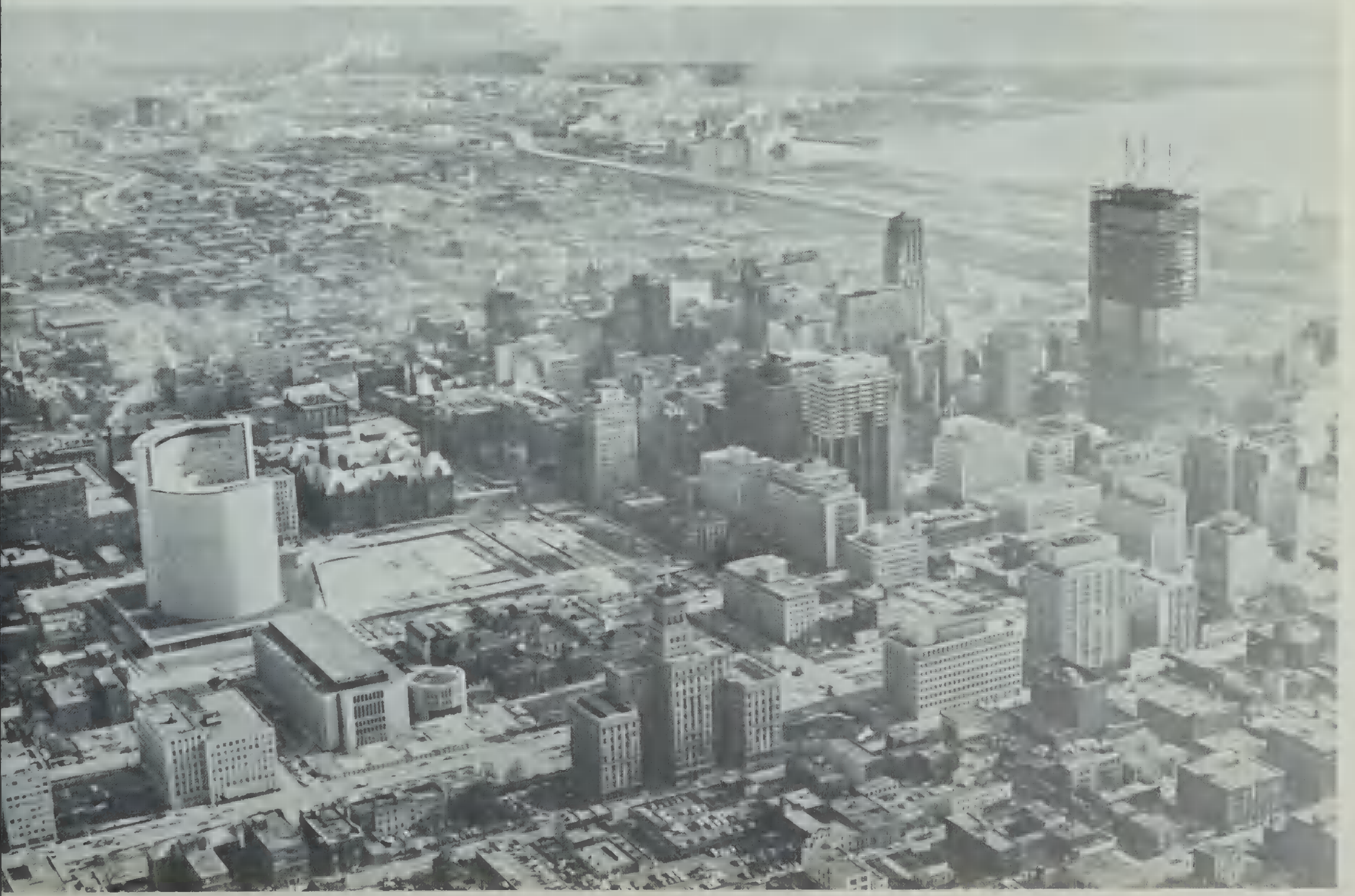
1. (*a*) Find the range of relief on the map.
   (*b*) Generally where is the highest land on the map?
   (*c*) Find two rivers that have their sources in this general area.

TORONTO 1



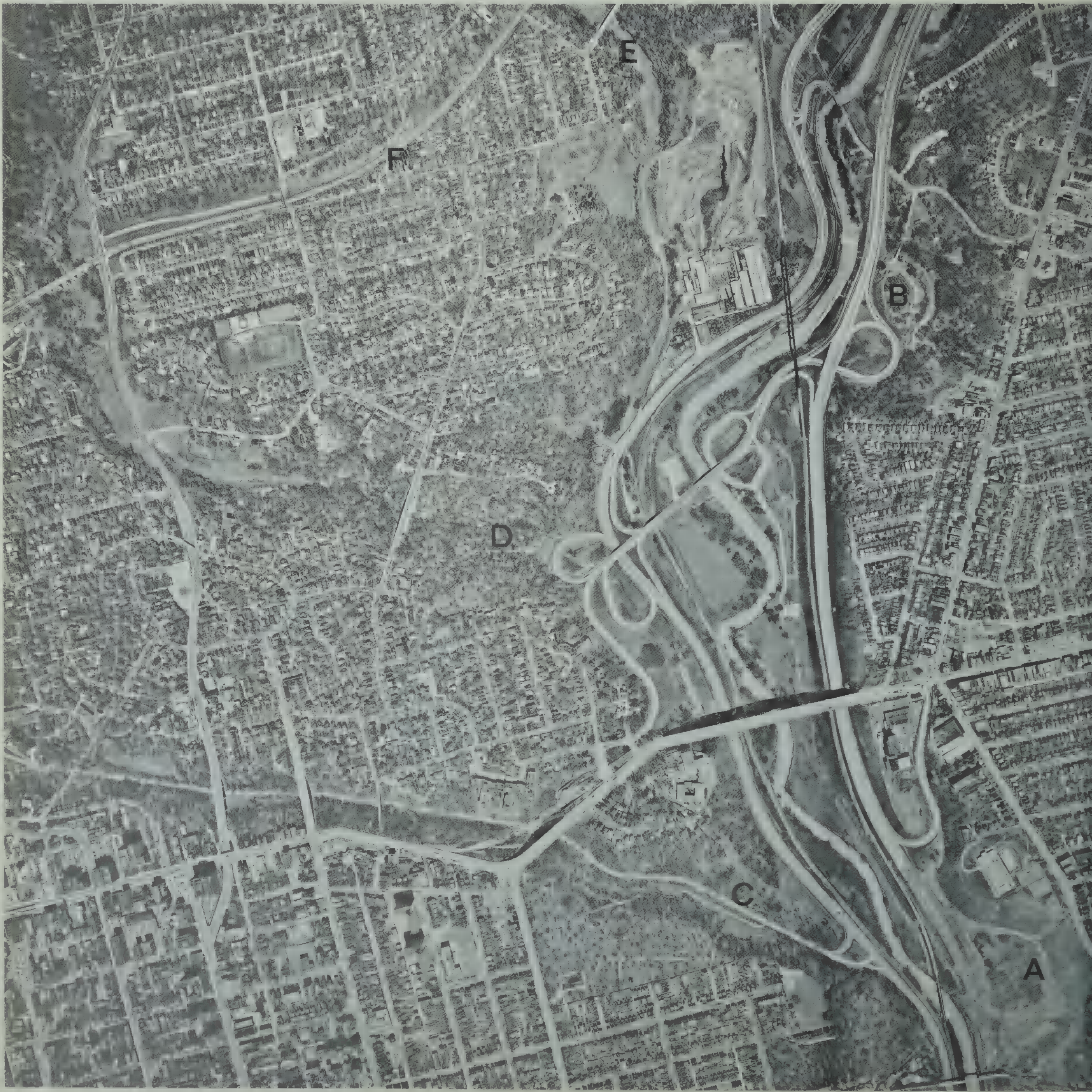
2. (*a*) Identify on the map and Photograph 1 the feature along the lakeshore from Birch Cliff to the northeast. How high is this feature? Account for the excessive gullying that has taken place.
   (*b*) Is the shoreline emerging or submerging along the lakeshore to the south and west of Birch Cliff? Find two reasons to justify your answer. Refer to the town plan, the map and Photograph 2.
3. (*a*) Identify on the town plan the features A and B shown on Photograph 3. How were these created?
   (*b*) Identify on the town plan the features C, D and E shown on Photograph 3. How were these created? What does the depth of these features indicate about the surface material?
   (*c*) Considering the influence of glaciation in this area, what do these features indicate about the history of the Don River?
   (*d*) With reference to Photograph 4 and the town plan, what has been done to the lower part of the Don River? Why was this done?
4. (*a*) From a study of Photograph 2 and the map, what type of formation are the Toronto Islands? Referring to your answer to question 2(*a*) and Photograph 1, where would the material that created Toronto Islands originate? What does this indicate about the direction of current and wave action in times of storm?
   (*b*) What does the hook-shape of the island indicate about the normal direction of current and wave action?
   (*c*) What was the importance of the Toronto Islands in the establishment of the port of Toronto?
   (*d*) What construction advantages are available in such a site for a port? Refer to Photograph 5. What problems may be encountered? Compare this situation to the ports of Paris and London.
5. (*a*) How did the character of the Don River valley and its tributaries dictate the pattern of Toronto's growth? Refer to the letters A and B on Photograph 4. Find these areas on the town plan. Use these areas to illustrate your answer. How did both the Don and Humber river valleys create transportation problems?

TORONTO 2



6. (*a*) Find on the town plan and map the railway line shown by the letter F on Photograph 3. Name and give the height of the physical feature immediately north of the railway line in the Rosedale area. Try to locate this feature on Photograph 6. How does it appear?
   (*b*) During immediate post-glacial times Lake Ontario was larger than it is today. What then does the feature referred to in part (*a*) represent? How would it have a bearing on the early growth of the city?

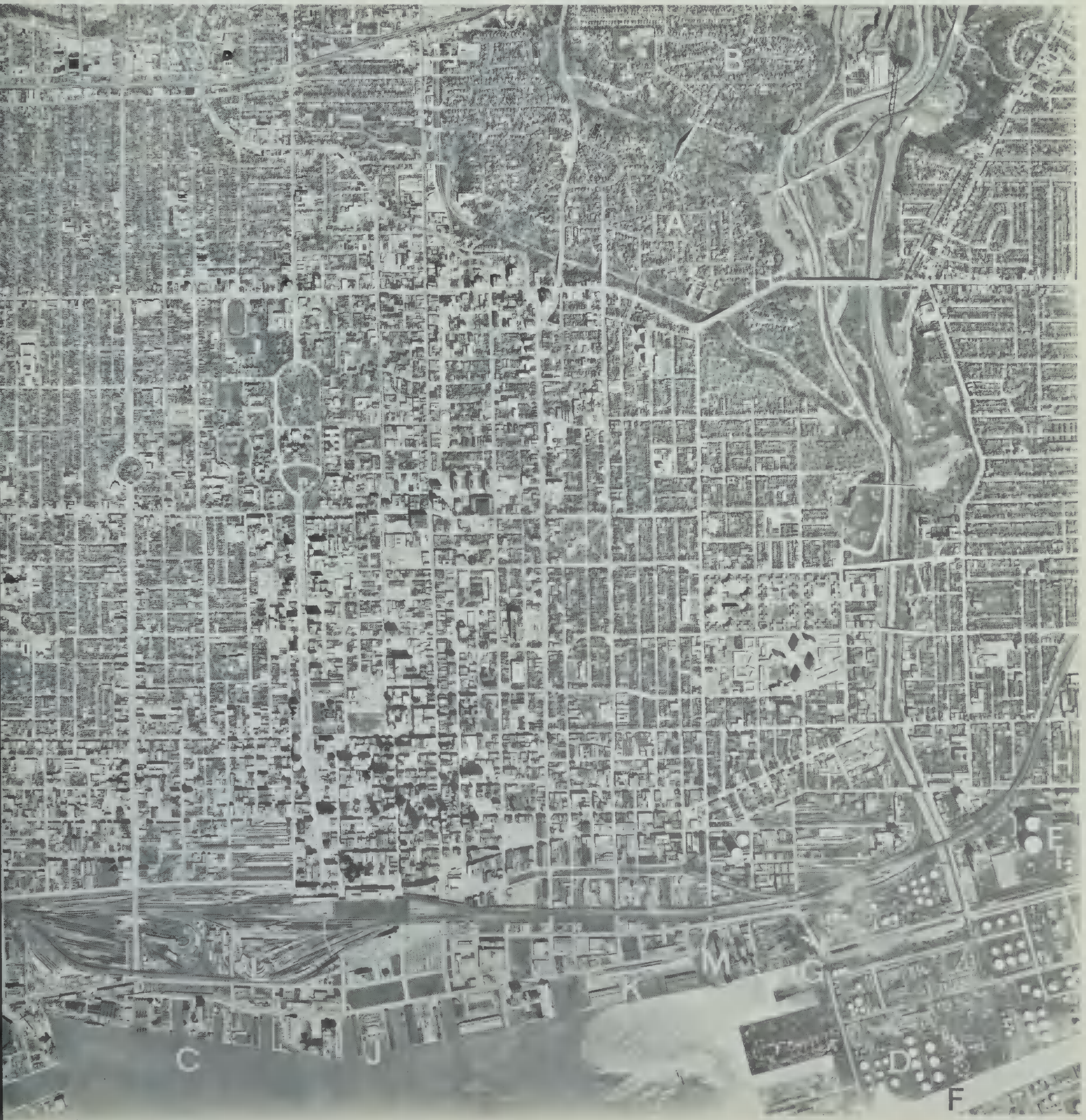
TORONTO 3



(*c*) This feature corresponds to the 450′ contour line on the map. Trace this feature east and west through the city.

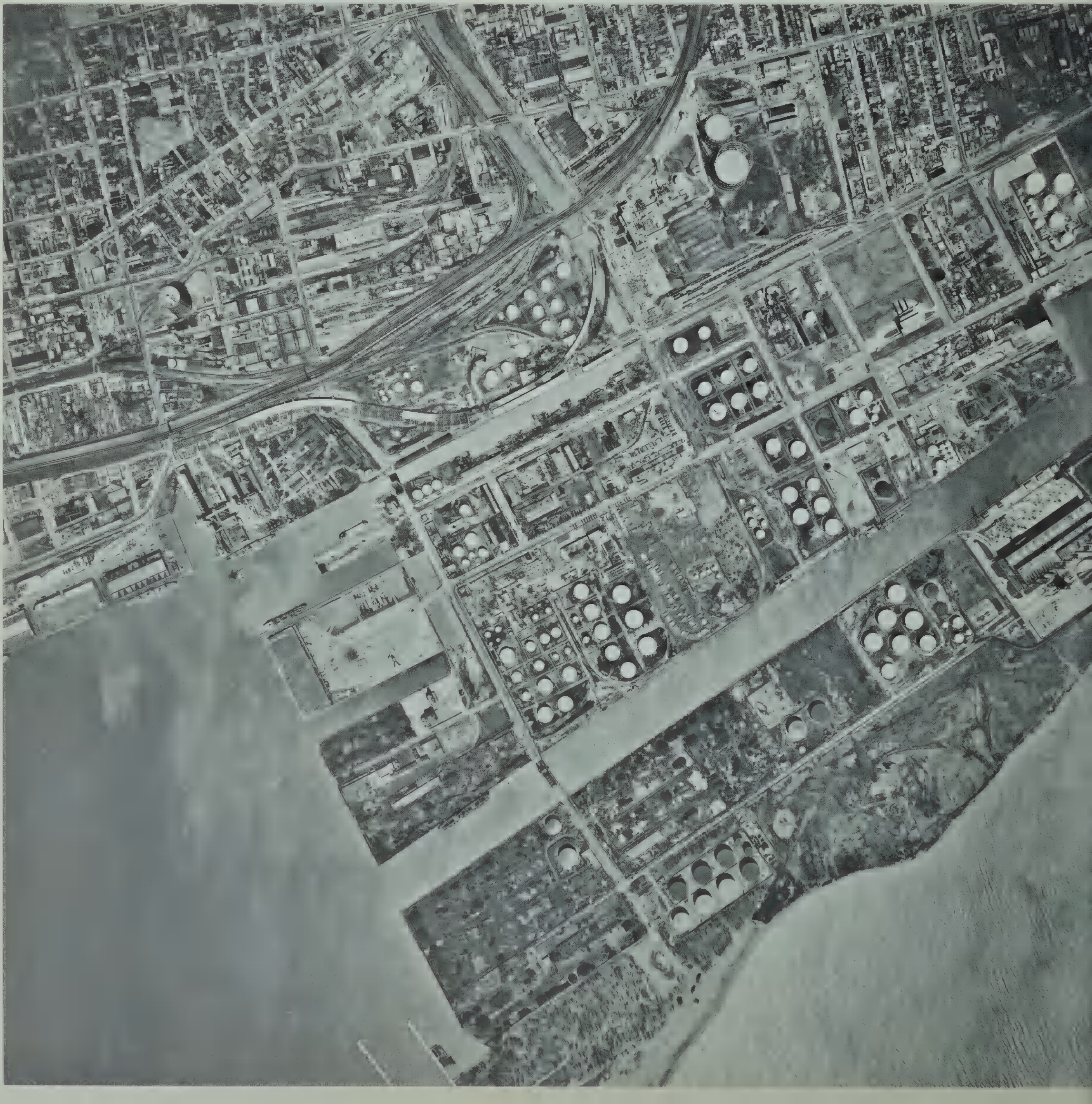
7. Using every second contour line draw a profile or cross section from Caledon (along the west edge of the map) through Islington to the shoreline of Lake Ontario. Using the following terms, label the cross section: Till Plain, Scarp Slope, Old Shoreline.

TORONTO 4

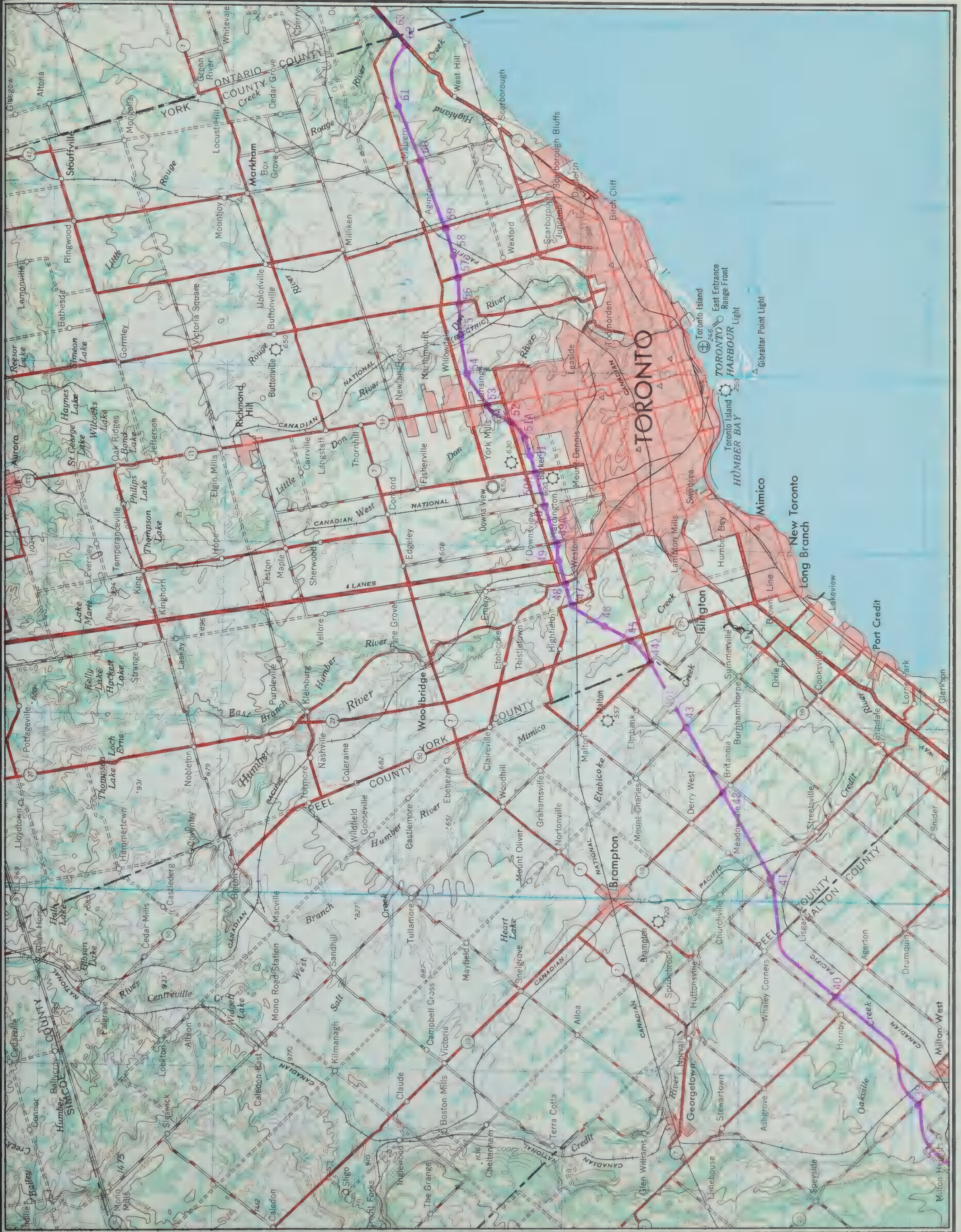


8. (*a*) Find a place-name on the map that suggests the origin of the highland on the west side of the map.
   (*b*) Show how the highlands to the north are different in appearance from the highlands to the west.
   (*c*) Near what town do the two highland areas merge?
9. (*a*) What is the decline in elevation on the Till Plain between the foot of the escarpment at Caledon East and Islington? What is the gradient of the land?

TORONTO 5



TORONTO ←



(*b*) Draw a sketch of the map area showing the bordering highlands, lakeshore and the city. On this show the Don, Humber and Credit River systems with two right and left bank tributaries in each case. What type of drainage pattern is apparent?

(*c*) Find the two source areas for the Humber River.

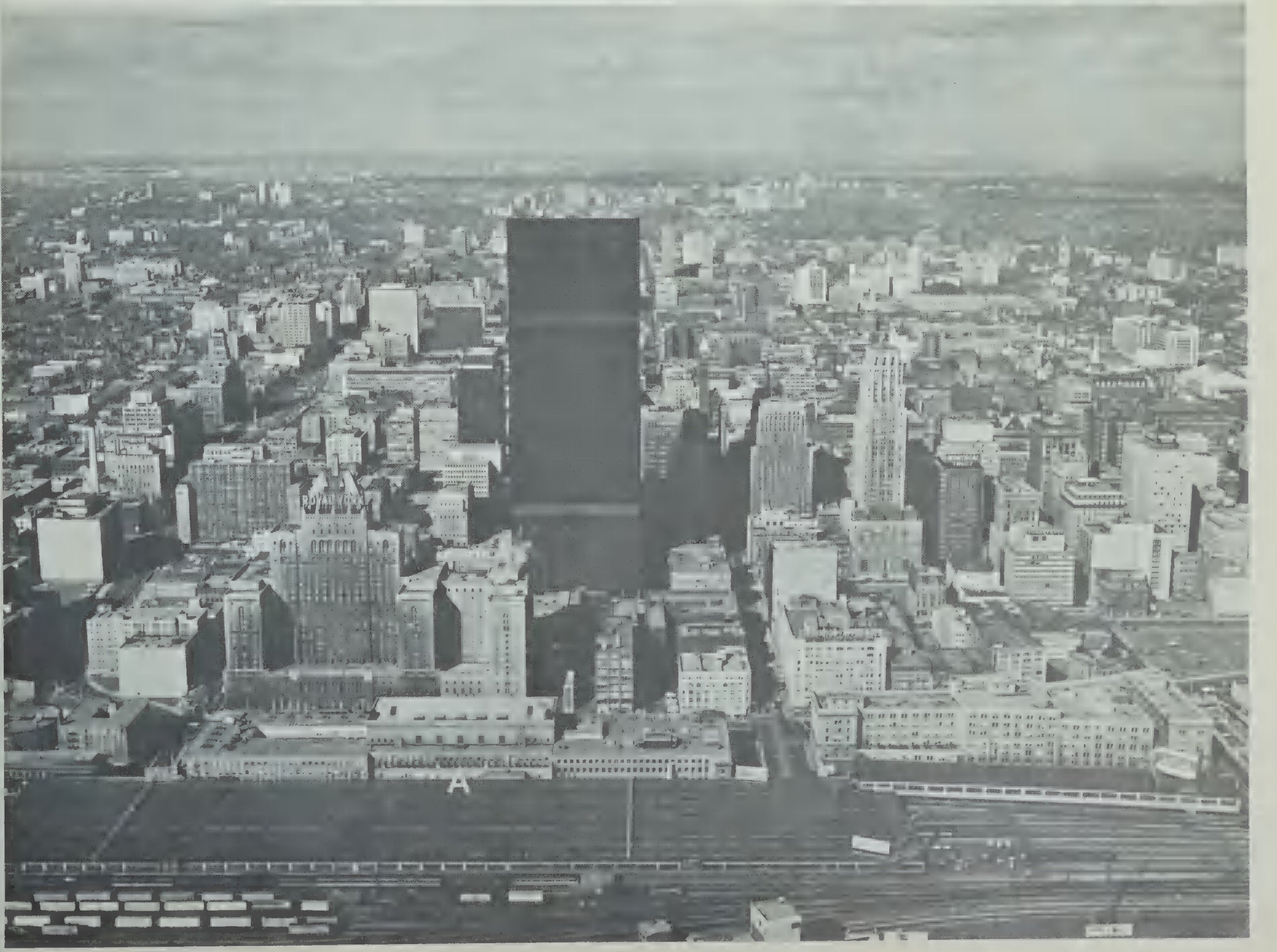
(*d*) What evidence is there that the Humber River is a misfit stream? Why doesn't the railway follow the valley more closely?

(*e*) Photograph 7 shows a community on the Humber River and the river itself. From a study of the road pattern and any other relevant features, identify from the map the community shown. The community may be divided into two parts. Describe the sites of the old and the new parts. Study closely the topographic map and the photograph. What danger existed in the old part that prompted the building of the new?

(*f*) Identify the features shown by the letters A to G on Photograph 7. The letter G refers to a form of erosion.

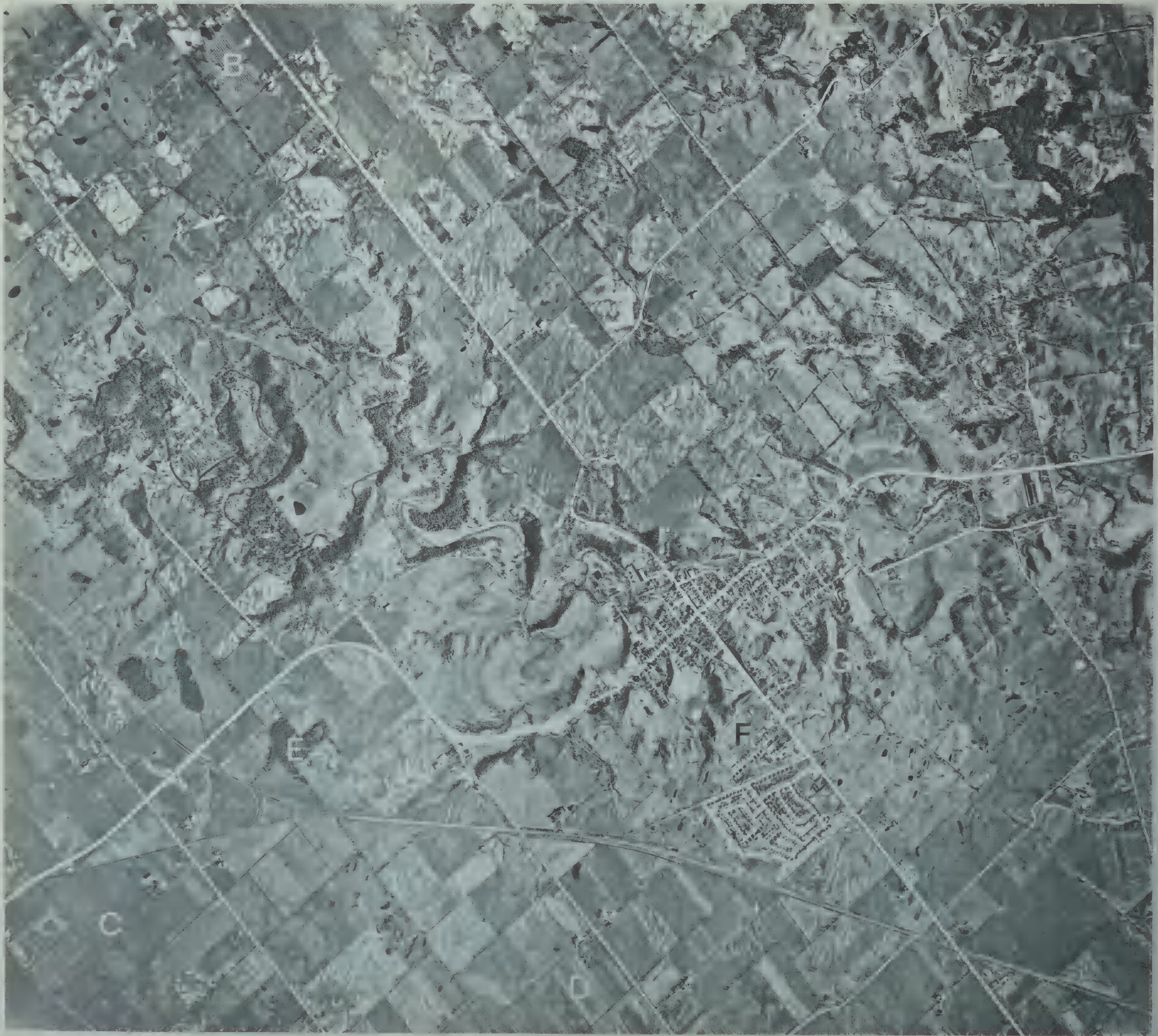
(*g*) Determine the approximate percentage of forested land in Photograph 7.

TORONTO 6



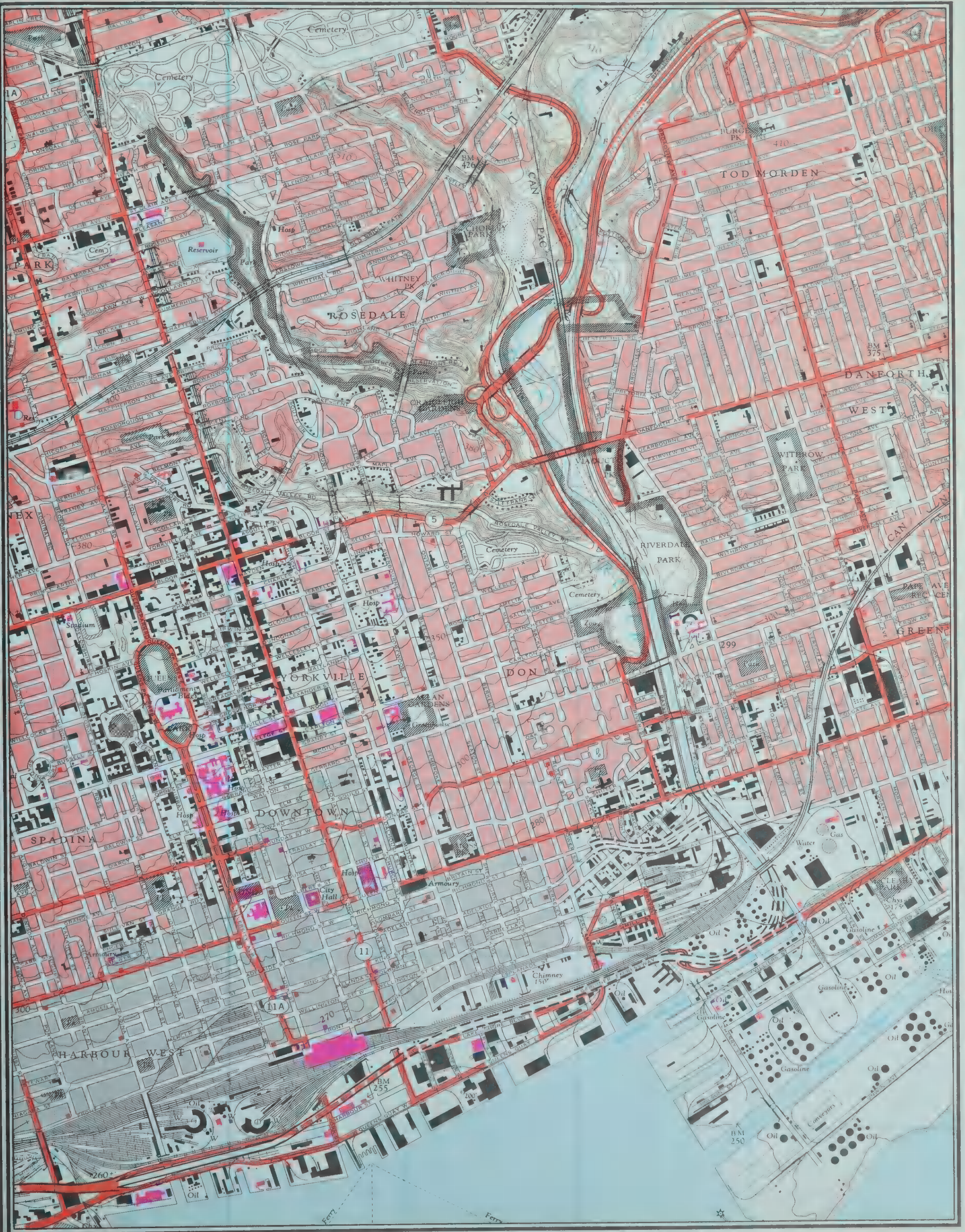
10. Photograph 8 was taken in the same general area as photograph 7.
    - (*a*) Name and account for the type of erosion shown on this photograph.
    - (*b*) Find other examples of this type of erosion on Photograph 7. How does this type of erosion influence stream flow?
    - (*c*) What dangers exist for communities downriver when a stream's watershed is exposed to this type of erosion? What danger exists for agriculture in the area?
    - (*d*) What immediate steps can be taken to remedy this situation? What long-term program can be introduced? Find an example of this type of program in your general area.

TORONTO 7



TORONTO TOWN PLAN

Scale 1: 25,000

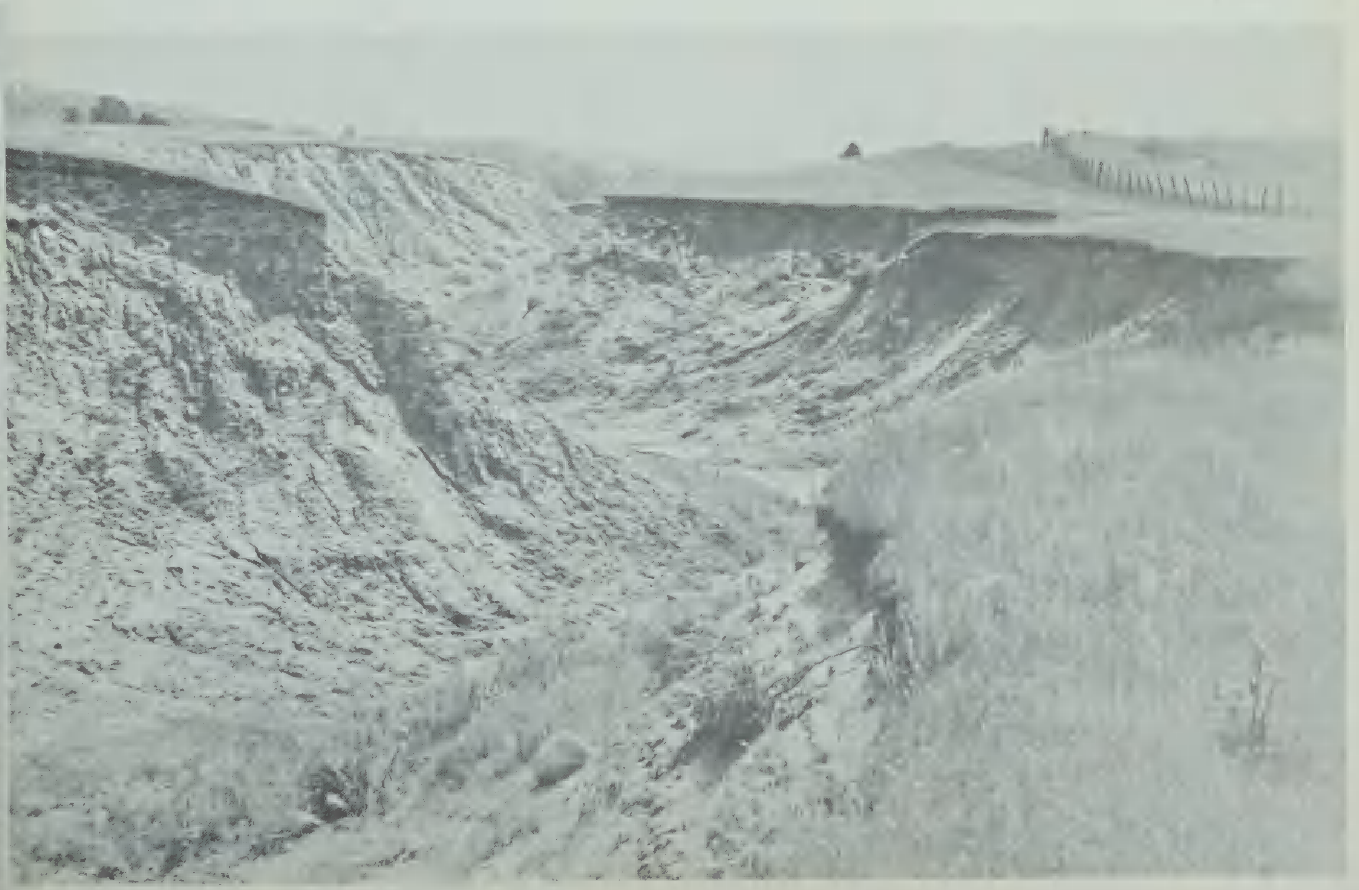

Cemetery
ROSEDALE
WHITNEY PK
CHORLEY PARK
Reservoir
TODMORDEN
DANFORTH WEST
WITHROW PARK
RIVERDALE PARK
YORKVILLE
DON
DOWNTOWN
SPADINA
HARBOUR WEST
Stadium
Queen's Park
Parliament Bldgs
City Hall
Armoury
ALLAN GARDENS
Hosp
CAN PAC
Oil
Gasoline
Gas
Water
Chimney
BM 426
BM 375
BM 255
BM 250
Ferry
5
11
11A

11. (*a*) How many major rail lines lead into the city of Toronto?
    (*b*) How do the routes followed by most of these rail lines conform to physical features? Find an example on the map of how a railway line has used a gap through the escarpment on the west.
    (*c*) Where do most of these railway lines terminate within the city of Toronto? Find the area on the town plan and Photograph 4. What other forms of transportation serve this same area?

12. (*a*) From a study of the town plan, how high above the lake level are the dock facilities? What does this indicate about the origin of the land being used for dock facilities? What had to be done in order to make this land suitable for dock facilities? Refer to Photograph 5.
    (*b*) Determine the main land uses south of the railway tracks through the identification of the letters C to M on Photograph 4. Use the town plan for reference. In the case of letters E and G refer also to Photograph 5.
    (*c*) Study Photograph 9. List as many activities as you can in the general dock area.
    (*d*) Account for the presence of an area of light industry north of the railway tracks and immediately west of the Don River. How are transportation facilities being improved in this general area? Refer to the town plan and Photographs 5 and 9. Identify the new road shown on Photograph 9. What method of construction was used? Why was this necessary? Which is more recent, Photograph 5 or 9?
    (*e*) What has been the effect of the concentration of industries along the banks of the Don River on the waters of the river? What similar problem is indicated by the background of Photograph 2?

13. (*a*) Letter A on Photograph 6 shows the railway sheds and Union Station. Find the Union Station, shown in pink, on the town plan. From a study of Photograph 6, how does land use change immediately north of the Union Station?
    (*b*) The heart of the Central Business District in Toronto surrounds the street leading north from the railway yards and immediately east of the tall new building in the centre of Photograph 6. Identify this street from the town plan.
    (*c*) The area north of the railway tracks, shown in a light gray colour on the town plan, is the business district of the city. However, the Central Business District of Toronto, where most commerce is transacted, is found between Front street on the south, Gerrard Street on the north, University Avenue on the west and Church Street on the east. Find these streets on the town plan and on Photograph 4. Within the Central Business District, what indication is there of the height of the buildings? List as many activities as you can for this area from a study of Photographs 2 and 6.
    (*d*) In which direction was Photograph 2 taken? Identify the old and new city halls. Which is shown on the town plan?

TORONTO 8

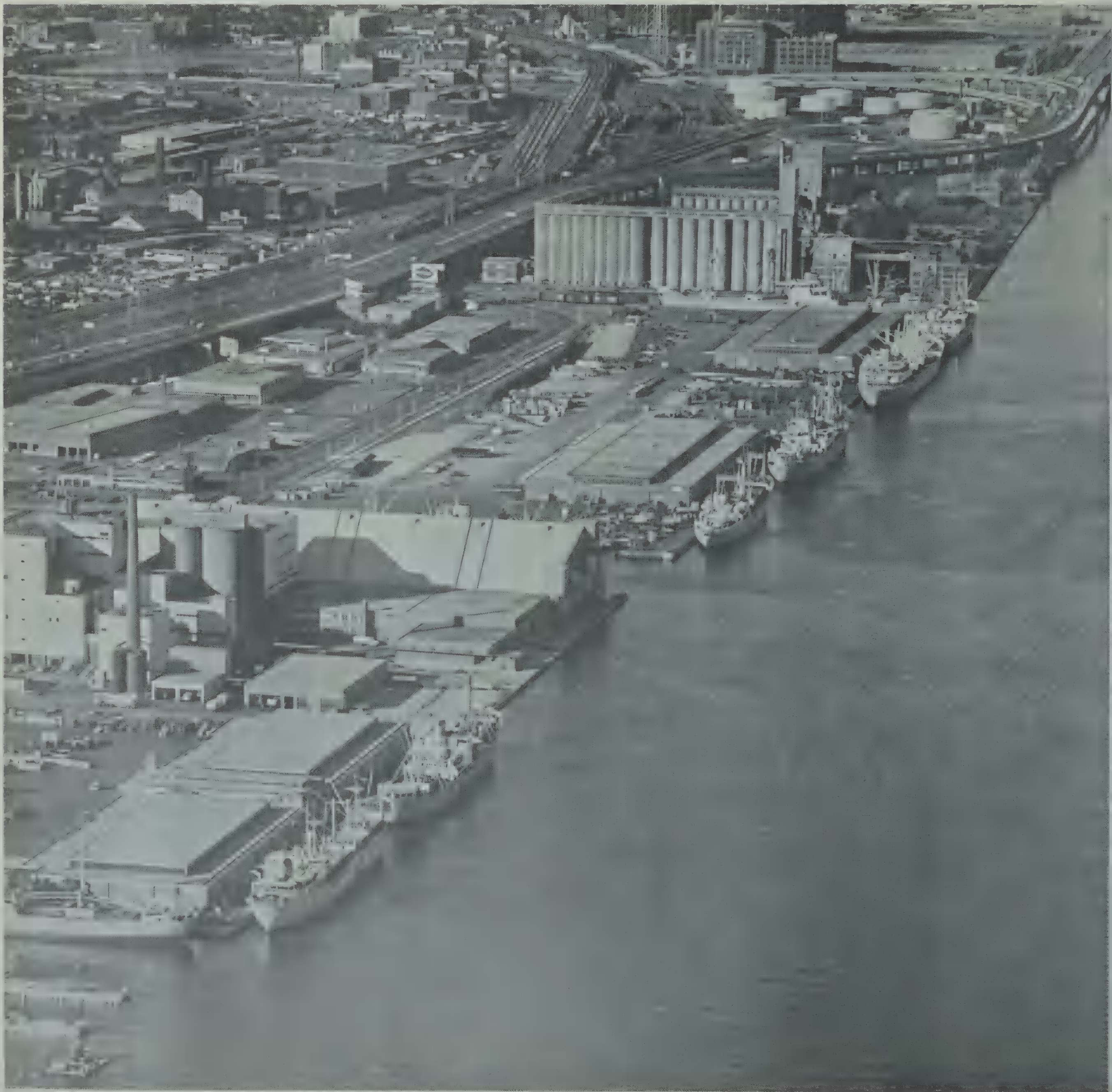


(*e*) How does the land use change generally to the east and west of the Central Business District? Study Photographs 2 and 6 as well as the town plan.

(*f*) Find the Parliament Buildings on the town plan and Photograph 4. What street leads south from the Parliament Buildings? List four other land uses closely associated with this street.

14. From a study of the town plan and Photograph 4, outline on a sketch map the functional zones between Toronto Harbour and Bloor Street west of the Don River.

TORONTO 9



SYMBOLS FOR FOREIGN MAPS

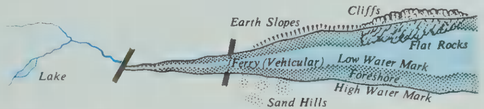
London

Roads:

Ministry of Transport, Motorway	M1 Junction
Ministry of Transport, Trunk, Single & Dual	A1(T)
Ministry of Transport, Class 1, Carriageway	A141
Ministry of Transport, Class 2	B1050
Other Tarred, Other Minor	═══ ======
Under construction	═ ═ ═ ═ ═

Railways:

Normal gauge	━━━
Narrow gauge	┅┅┅
Road crossing under or over	
Level Crossing	
Station	Open
Tunnel	━━ - - - ━━
Boundaries, National	+ – + – + – + –
Boundaries, Geographical County	- - - - - - - -
Gradient 1 in 7 or steeper, Toll	Toll
Buildings	
Wood	
Contours (in feet)	400 200
Submarine contours (in fathoms)	10 5
Canal	
Marsh	



Aerodrome (with customs facilities)	
Lighthouse	
Lightship	
Windmill	
Wireless or TV Station	
Height in feet above Mean Sea Level	·856

Triangulation pillar	△
Site of Roman antiquities	CANOVIVM •
Site of other antiquities	Castle •
Native fortress	
Site of Battle (with date)	⚔ 1066
Roman road (course of)	- - - - - -
Telephone call box	PO ... T AA ... A RAC ... R

London Town Plan (Additional symbols)

Double track railway line	
Railway station	Sta
Tunnel	======
Bridge	
Footpath	FP
Footbridge	FB
Tube station, with interchanges	○ ⊕
Boundary stone	BS
Boundary post	BP
Site of antiquity	+
Church with spire	
Church with tower	
Triangulation Station	△ △
Parkland	
Foreshore flats	
Swimming pools, outdoor baths, mill ponds or reservoirs	

Paris

Autoroute	A - 1
Routes principales : à chaussées séparées (1), de 6 m. et plus (2), de moins de 6 m. (3)	N. 186 1 N. 5 2 D. 46 3
Routes secondaires : large de 6 m et plus (1), de moins de [illegible] m (2)	N. 77 1 N. 394 2

Les routes à grande circulation, prioritaires (Nationales ou Départementales) sont numérotées en gros caractères

Distances kilométriques (totalisées entre ⚲ ou villes importantes)	2 1 3
Autres routes : régulièrement entretenue (1), irrégulièrement entretenue (2)	1 2
Chemin d'exploitation, laie forestière (1). Sentier (2). Sentier muletier (3)	1 2 3
Chemins de fer : à 2 voies (1), à 1 voie (2), à voie étroite (3)	1 2 3
Gare, station (1). Halte, arrêt (2). Tunnel (3)	1 2 3
Passages : à niveau (1), inférieur (2), supérieur (3)	1 2 3
Câble transporteur, téléphérique (1). Ligne à haute tension (60 kV et plus) (2)	1 2
Limite d'Etat	+ + + + + + + + + + + + + + + + + + + +
Limite et Chef-lieu de Département	PF
Limite et Chef-lieu d'Arrondissement	SP
Limite et Chef-lieu de Canton	CT
Limite de Commune	....
Passages de rivière : pont isolé (1), bac (2), gué (3). Barrage (4)	1 2 3 4 B.
Canaux : navigable (1), non navigable (2)	1 2
Ecluse (1). Gare, port (2). Tunnel (3). Réservoir (4). Château d'eau (5)	1 2 3 4 5
Aqueducs : sur le sol (1), souterrain (2), sur pont (3)	1 2 3
Lacs ou étangs : permanent (1) périodique (2). Marais (3)	1 2 3
Marais salants (1). Sables et rochers recouverts à marée haute (2)	1 2

Maison ou groupe de maisons (1). Maison forestière (2)	1 ▬ M^on F^re 2 ▬
Eglise (1). Chapelle (2). Calvaire (3)	1 ○ 2 ♁ 3 †
Monuments : mégalithique (1), commémoratif (2). Cimetière (3)	1 ⊓ 2 • 3 † † † †
Château (1). Tour (2). Ruines (3)	1 ▬ 2 ● 3 ∴
Phare (1). Usine (2)	1 ★ 2 ✲
Moulins : à vent (1), à eau (2). Eolienne (3)	1 2 ☆ 3
Carrières : souterraine (1), à ciel ouvert (2). Mine (3)	1 ∩ 2 ∪ 3 ⚒
Ouvrages de fortifications : fort (1), batterie (2)	1 2 ≻–≺
Emetteurs : de radiotéléphonie (1), de radiotélégraphie (2)	1 2
Aérodrome : pourvu d'installations (1), non pourvu d'installations (2)	1 ✈ 2 ✈
Héliport :	

Lieux habités	plus de 100 000 habitants	**Paris**
	de 5 000 habitants et plus (zone urbaine)	COURBEVOIE
	de 5 000 à 25 000 habitants	VILLEPINTE
	de 1 000 à 5 000 habitants	Villenoy
	moins de 1 000 habitants	Gouvernes
	hameau	la Cité
	maison isolée, ferme, château, chapelle, fort, etc...	Élysée

Chiffre de population en milliers d'habitants	15,7
Point géodésique (1). Cote (2)	1 △ ⊙ 2 72.
Limite de camp militaire	— × — × — × — × — × — × —
Bois (1). Broussailles (2). Vignes (3). Vergers (4)	1 🟩 2 🟩 3 ☐ 4 ☐

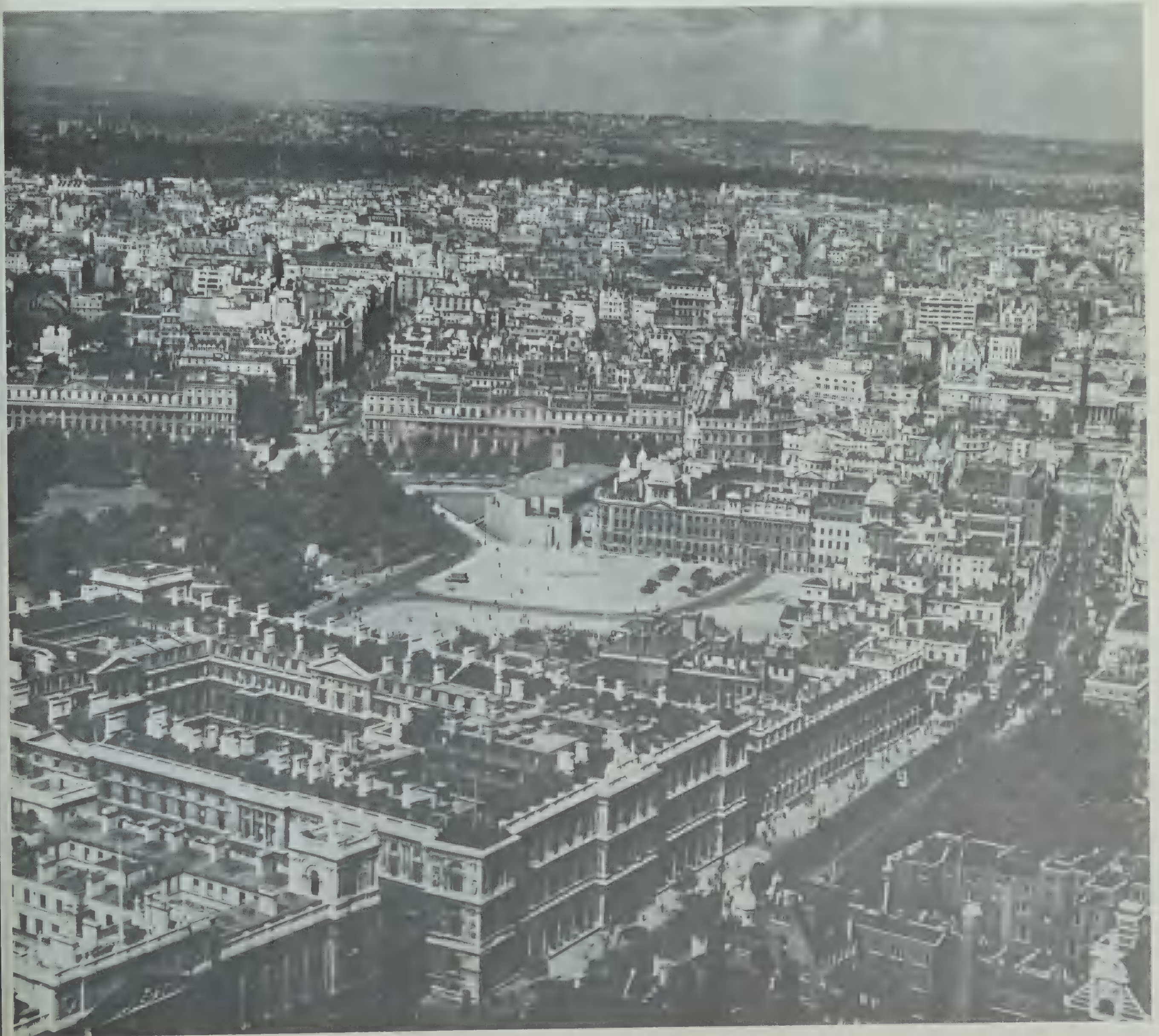
LONDON

The London Basin is a V-shaped plain bordered on the south by the Northdowns and on the north by the Chilterns. These two highland areas link to the southwest and spread out in a "V" fashion to the northeast and east from there. It should be noted that the contour line nearest the river on the city plan is the 25′ contour line.

Assignment

1. How does the drainage pattern on the map illustrate the fact that London is in a basin? How high are the Northdowns on the south? Photograph 1 is a view to the northwest. Is there any indication from the photograph that London is in a basin?
2. The Northdowns, a chalk escarpment, form the southern rim of the London Basin. Between the Northdowns and the city is a discontinuous belt of sands, gravel and pebble deposits. The city itself is built on clay.

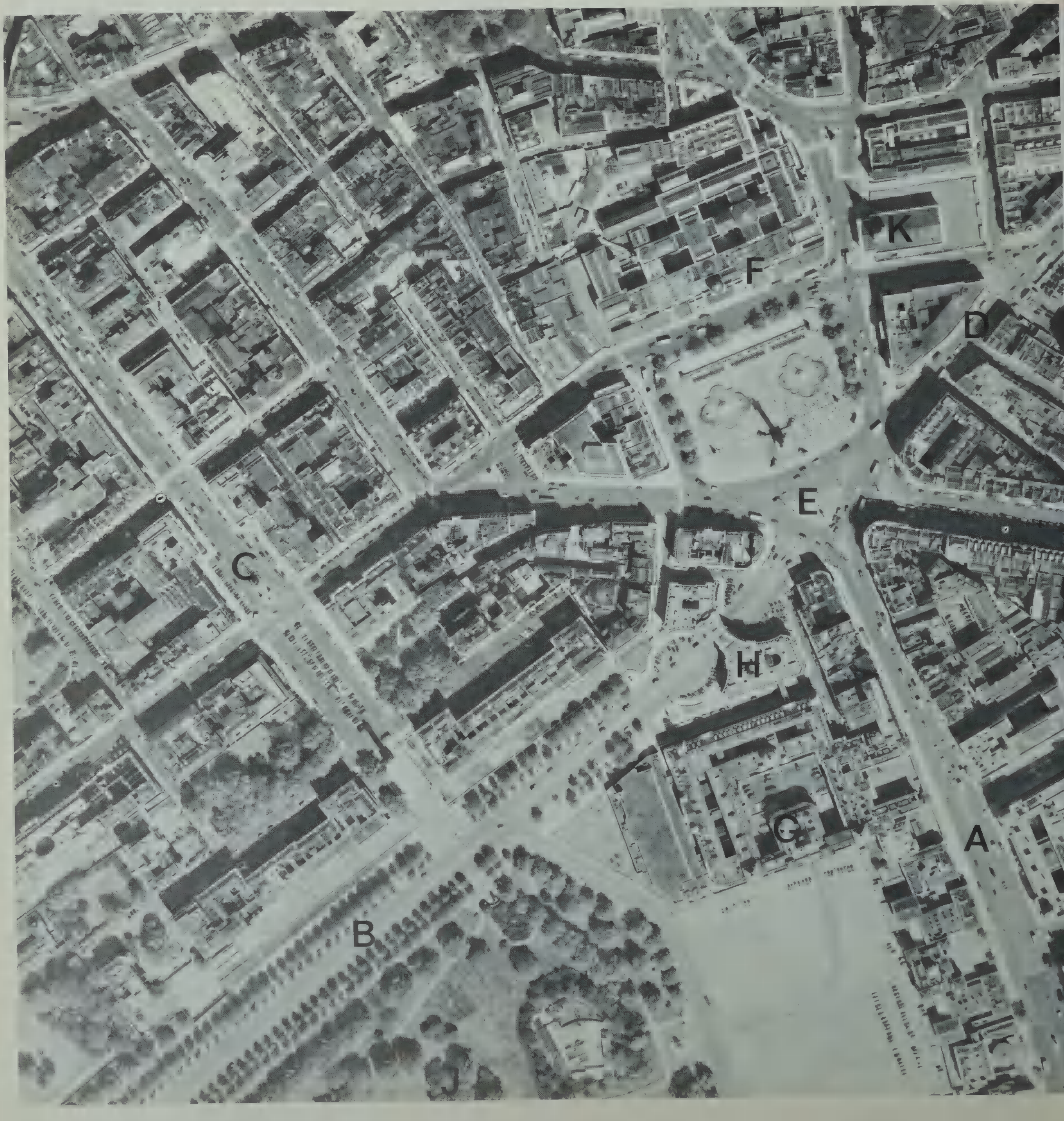
LONDON 1



(*a*) What evidence is there that the rocks composing the Northdowns are of a porous nature? As a result of the nature of the rock, suggest possible agricultural land uses.

(*b*) Find the 200′ contour line on the north slope of the Northdowns. From a study of drainage along the contour, what evidence is there that this contour generally marks the northern limit of the Northdowns?

LONDON 2



(*c*) Follow the rivers that flow through (i) Dorking and Leatherhead, (ii) Sevenoaks. Is there any indication along the courses of these rivers to the type of material underlying the chalk?

(*d*) (i) How was the gap through Leatherhead created?
(ii) Find Biggin Hill to the northwest of Sevenoaks. Trace the 200′, 400′ and 600′ contour lines in the immediate area. What feature is outlined by the configuration of these contour lines?

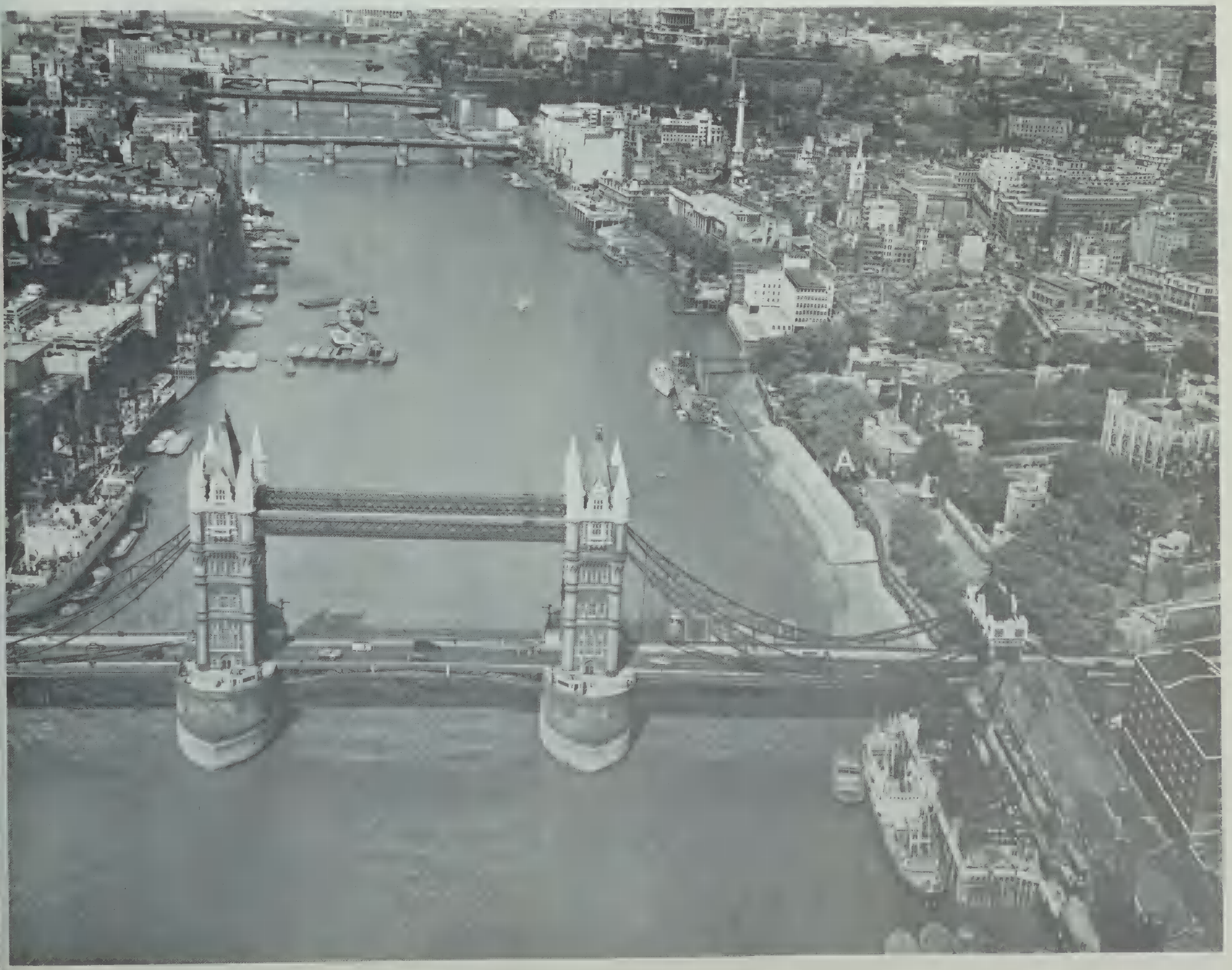
3. London is located on the Thames River.

(*a*) What indications are there that the Thames is an old river? Refer to both the map and the town plan.

(*b*) Study the shading of the Thames River on the map. The grayish-blue indicates the portion of the river that is tidal. The royal blue denotes the non-tidal part of the river. How far upriver do tidal influences extend? What type of river mouth would the Thames have?

(*c*) On the city plan find the 25′ contour line. What geographical term would you use to describe the area between the 25′ contour line and the river?

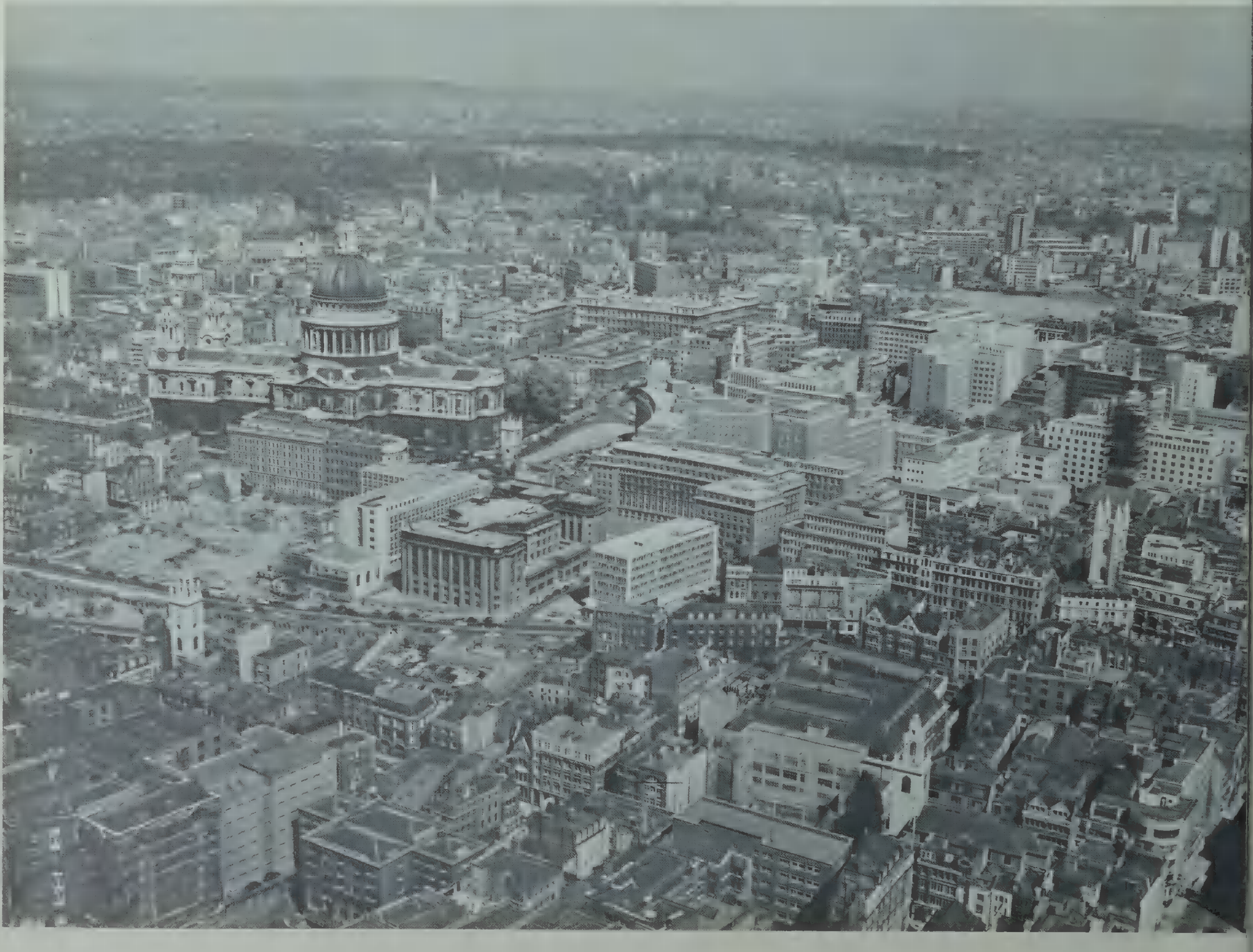
LONDON 3

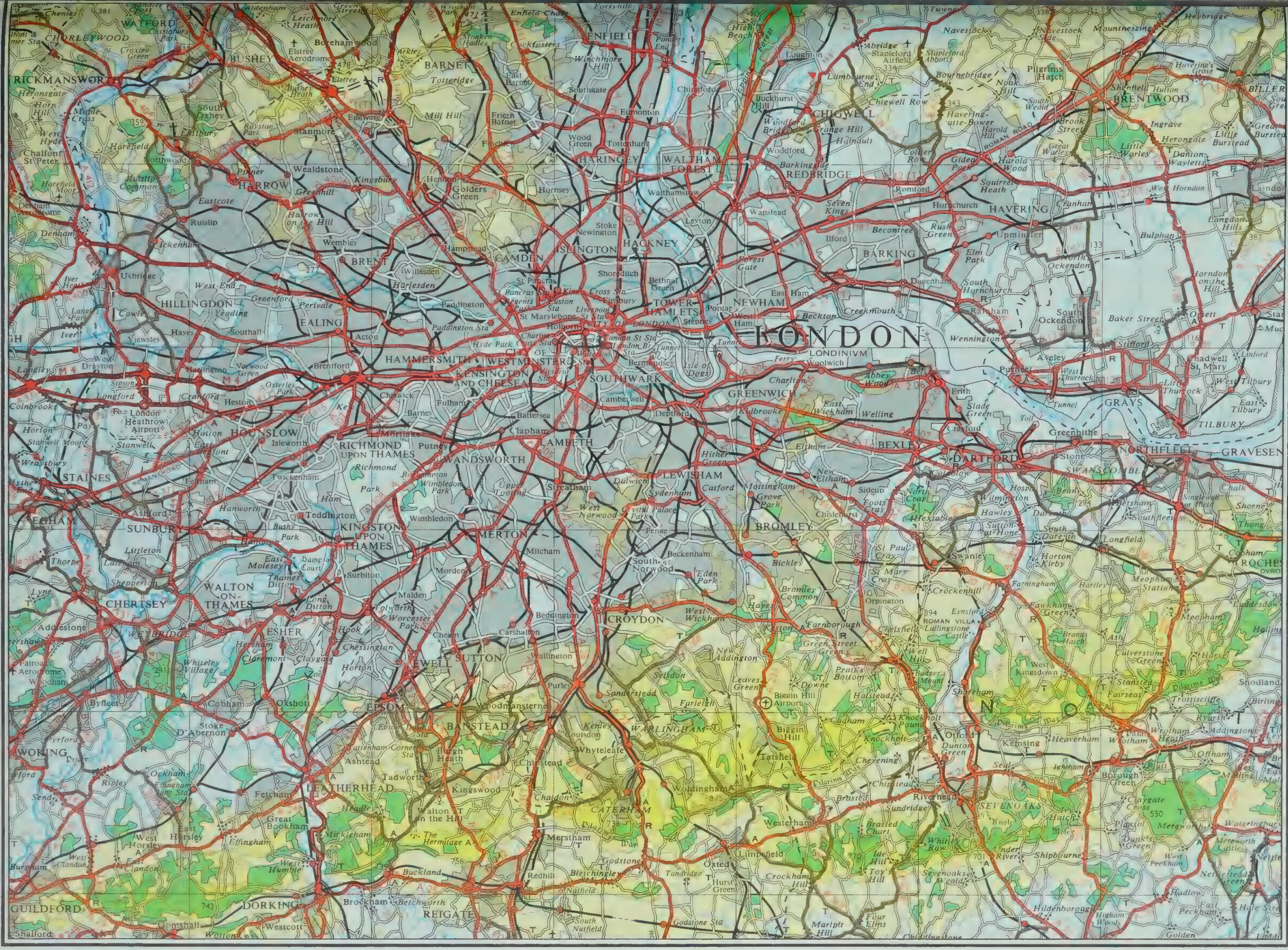


4. (*a*) London was founded by the Romans. Find three examples of Roman roads on the map. At what bridge on the Thames River do they meet?
   (*b*) London was built on two outcrops of gravelly soil that stood above the marshes and formed the nucleus of the Roman settlement. St. Paul's Cathedral stands on one of these outcrops. Find the Cathedral on the city plan and on Photographs 3 and 4. What value were these hills bordering the river?
   (*c*) Photograph 3 of the Thames River shows an upriver view, i.e. looking westward. The bridge in the foreground is Tower Bridge with London Bridge next upriver. Identify these bridges on the city plan.
   (*d*) The building opposite Tower Bridge on the north bank is the Tower of London, the entrance to which was through the River Gate or Traitors Gate, shown by the letter A. Find this building on the city plan.
   (*e*) Small boats at one time negotiated this water gate at low tide to enter the Tower. From a study of Photograph 3, what has been done to the Thames River in recent times to confine and control the river and make it more navigable for larger ships? Find this feature on the city plan. What is it called?
   (*f*) Prior to this work, what conditions would exist on the north bank at high and low tide? How far away from the river would these conditions exist?

5. Refer to Photograph 3 and the city plan.
   (*a*) Identify the bridges shown on the photograph other than Tower Bridge and London Bridge.
   (*b*) With reference to the photograph, which bridge marks the limit of navigation?
   (*c*) The river between London Bridge and Tower Bridge is known as The Pool of London. With reference to the vessel in the left foreground of the photograph, what type of bridge is Tower Bridge? What type of vessel dominates the Pool of London? What indications are there on the photograph and the city plan that this is a major cargo-handling area?
   (*d*) How is the river crossed downstream from Tower Bridge as opposed to upstream from the same point? What is the significance of this? Why was this form of crossing easily constructed?

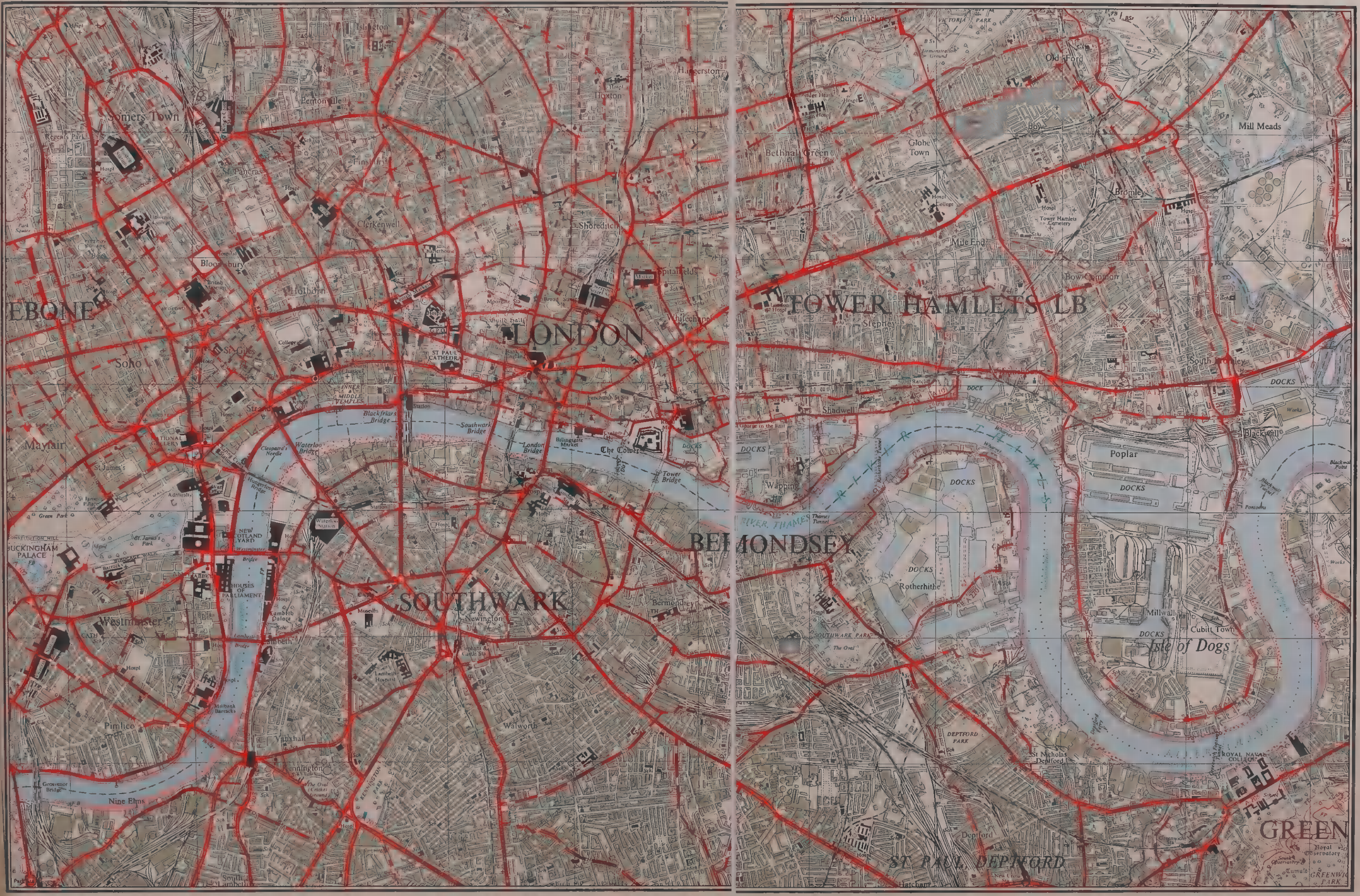
LONDON 4





LONDON TOWN PLAN

Scale 1: 25,000


Islington
Somers Town
Pentonville
Haggerston
Hoxton
South Hackney
VICTORIA PARK
Old Ford
Mill Meads
Bethnal Green
Globe Town
Bow
Bromley
Tower Hamlets Cemetery
Mile End
Bow Common
Finsbury
St Pancras
Clerkenwell
Shoreditch
Spitalfields
Bloomsbury
British Museum
Holborn
EBONE
Soho
St Giles
Guild hall
LONDON
ST PAUL CATHEDR
Whitechapel
TOWER HAMLETS LB
Stepney
South Bromley
DOCKS
Blackwall
Shadwell
Ratcliff
Wapping
INNER MIDDLE TEMPLES
Strand
Blackfriars Bridge
Southwark Bridge
London Bridge
Billingsgate Market
The Tower
Tower Bridge
Mayfair
St James's
Waterloo Bridge
Cleopatra's Needle
Hungerford Bridge
Green Park
CONSTITUTION HILL
St James's Park
BUCKINGHAM PALACE
NEW SCOTLAND YARD
Waterloo Station
Westminster Bridge
HOUSES OF PARLIAMENT
ABBEY
Lambeth Palace
Lambeth
Westminster
SOUTHWARK
Newington
Museum
Lambeth Hospital
BERMONDSEY
Bermondsey
RIVER THAMES
Thames Tunnel
Rotherhithe
SOUTHWARK PARK
Poplar
Millwall
Cubitt Town
Isle of Dogs
Blackwall Point
Pontoons
Millbank Barracks
Pimlico
Vauxhall
Walworth
Kennington
The Oval Cricket Ground
Grosvenor Bridge
Nine Elms
South Lambeth
DEPTFORD PARK
St Nicholas Deptford
Deptford
ST. PAUL, DEPTFORD
Hatcham
ROYAL NAVAL COLLEGE
GREEN
Royal Observatory
GREENWICH PARK

(*e*) What use has been made of the meanders of the Thames River? What construction advantages lay in the choice of these sites?

(*f*) Find examples of other waterways meeting the Thames River in the Isle of Dogs area. What type of commercial and industrial activity would naturally be found in an area served by two types of waterways?

6. "Barely a square mile in area and known as the 'City of London' the area is almost unpopulated at night, but at least half a million people pour into it every working day."[1]

(*a*) Find the City of London on the town plan.

(*b*) What buildings in the city indicate the main function of the area?

(*c*) The movement of such an immense number of people as mentioned in the quotation could only be facilitated by an underground subway system. The underground stations serving London are shown by a blue circle on the plan. How many stations serve "the City?" In what way was the construction of such an elaborate system, which carries two million passengers a day, aided by the underlying rock type?

7. "Although ridges of chalk surround the London Basin on three sides they do not seriously interfere with communication between London and the provinces, for they are broken by a number of gaps which are used by the main railways converging on the metropolis."[2]

(*a*) Find on the map four examples of gap towns in the Northdowns to the south.

(*b*) Find on the map and plan the two main stations south of the river where most railway lines through the gaps in the Northdowns terminate.

(*c*) Similar gaps north of the city exist in the Chilterns. Find on the map and where possible on the plan the seven stations north of the river where the railway lines from the north terminate.

(*d*) What similarities and dissimilarities exist between the railway network development of Paris and London?

8. (*a*) London has many administrative and governmental functions. Find the area on the town plan where most of these functions are concentrated. Name five major buildings concerned with them.

(*b*) On the town plan Trafalgar Square is named near the National Gallery. The statue of Nelson is shown on the plan by a black cross. Find these locations on the right centre of Photograph 1.

(*c*) Name the major thoroughfare entering Trafalgar Square from the foreground on Photograph 1. In what direction is the photograph facing?

(*d*) Photograph 2 shows vertically much the same area as Photograph 1. Relate this photograph to the town plan and name the streets and buildings lettered.

(*e*) What does London's outward rather than upward growth indicate about the underlying bedrock?

9. (*a*) Locate on the town plan the Royal Observatory in Greenwich. What is its geographical significance?

(*b*) How does the road pattern of London differ from that of Paris and most North American cities?

(*c*) London has often been described as a city of parks. Approximately what percentage of the land area of the city shown on the town plan is parkland?

(*d*) London has grown too big. Find the distance east to west and north to south on the map. What size of paper would be required to create a town plan of the city on the scale of 1:25,000?

10. (*a*) From an intensive study of the map, what geographical factors have enabled London to dominate its immediate hinterland, from the Chilterns in the north to the Northdowns in the south?

(*b*) Many references have been made to the functions performed by London. In point form list as many of these as possible.

(*c*) London, Paris, and Montreal have many features in common. Account for the fact that London is by far the largest city.

---

[1] J. A. Morris, The British Isles (Thomas Nelson and Sons, 1960), pp. 67-68.

[2] D. M. Preece and H. R. B. Wood, The British Isles Book II, Modern Geography, (University Tutorial Press, 1954), p. 182.

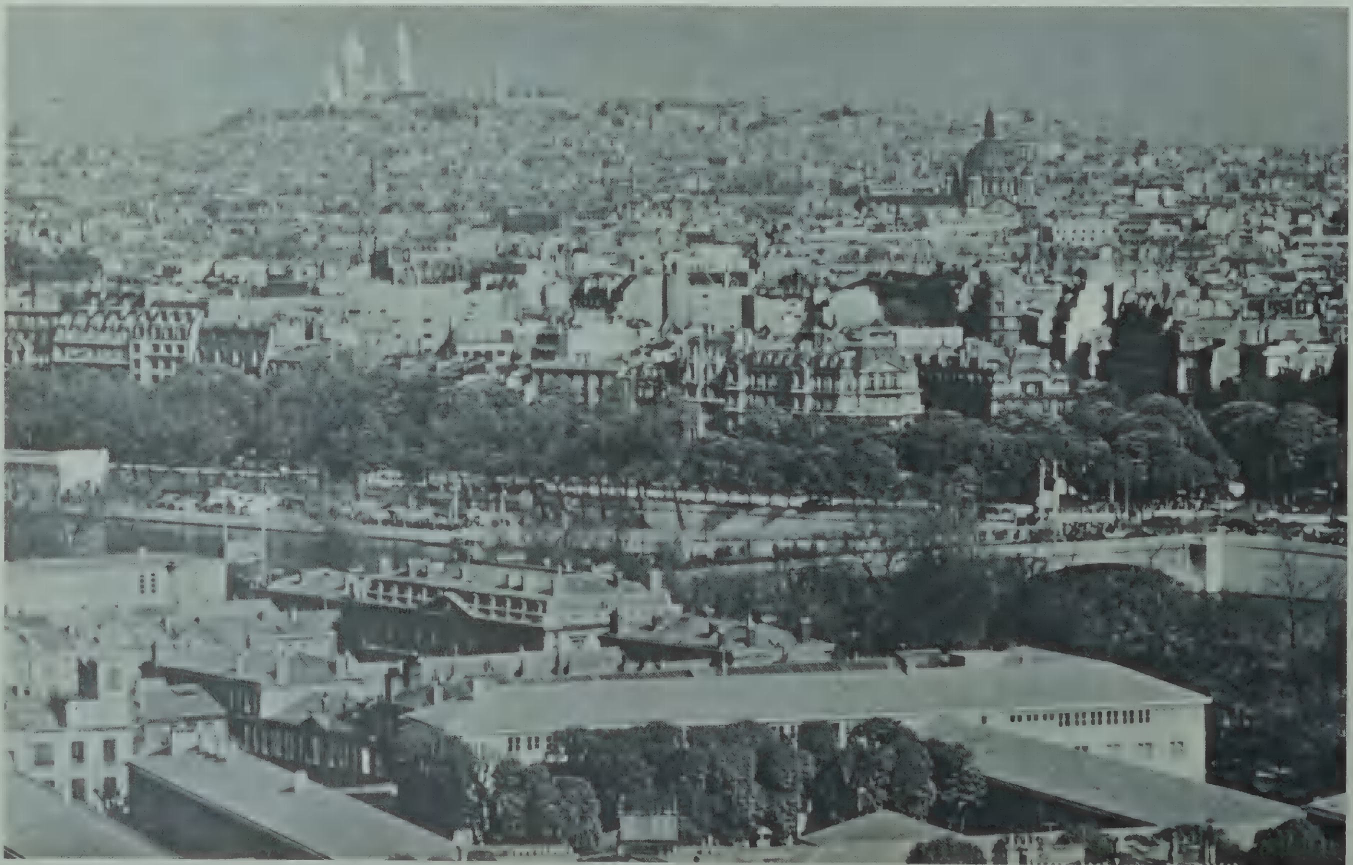
PARIS

Paris, the capital city of France, is just to the west of the confluence of the Marne and Seine Rivers. The major river, the Seine, flows through the heart of the city.

Assignment

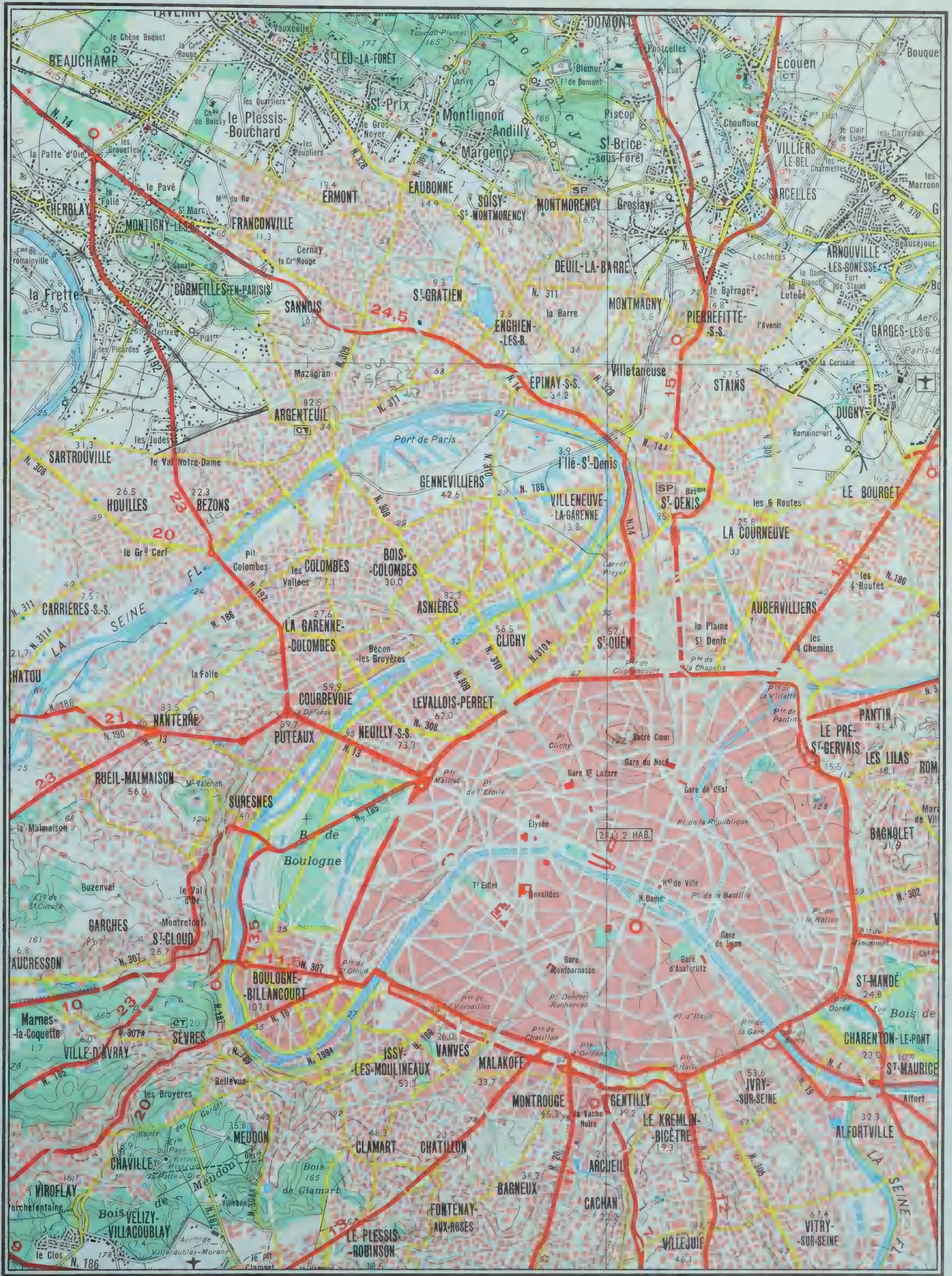
1. How many kilometres is the confluence of the Seine and Marne Rivers from the Ile de la Cité (Notre Dame)? What is this distance in miles?
2. Paris lies in a basin bordered by higher land. To see this, find the elevation of the river in metres near Issy-Les-Moulineaux. Now find the elevation of the Forêt de Montmorency area to the north, Bois de Clamart to the south, and Mt. Valerien west of the river near Suresnes.
3. (*a*) The highlands south of the river terminate in a series of limestone outcrops creating a bluff condition overlooking the river. Using the 35-metre spot height near the Porte de Versailles, estimate how close the 40-metre contour comes to the Ile de la Cité. This contour represents the bluff referred to.
   (*b*) Find the 40-metre contour north of the river. How close does it come to the Seine?
   (*c*) On which bank is there more flat land in this area?
   (*d*) What does the 40-metre contour north of the river probably outline?

PARIS 1



PARIS

Scale 1: 100,000

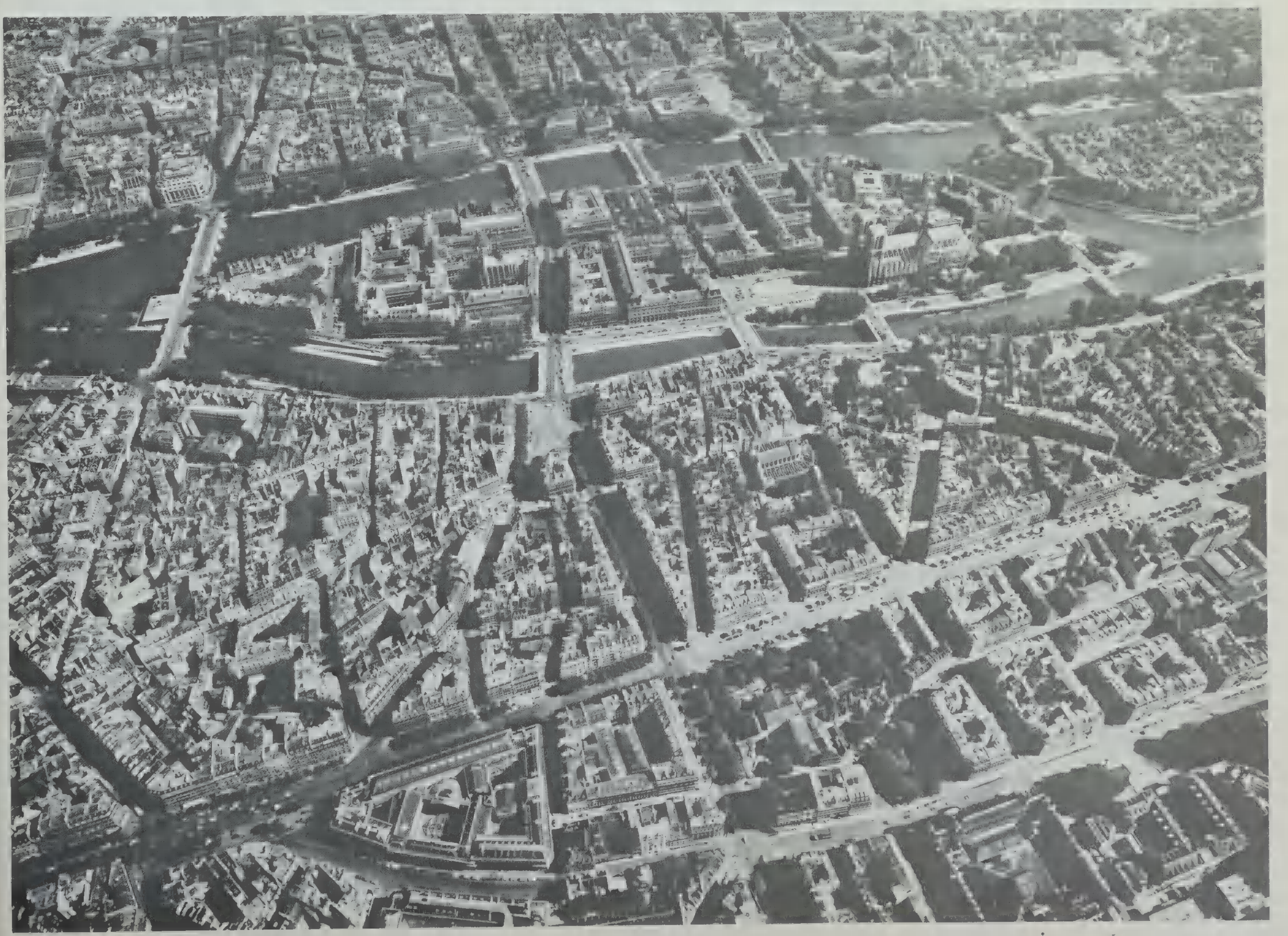

Domont
Beauchamp
le Chêne Boquet
Vauxcelles
St Leu-la-Forêt
Écouen
Bouqueval
Pontcelles
Blémur
Ft de Domont
St Prix
Montlignon
Andilly
Margency
Piscop
St Brice-sous-Forêt
Chauffour
Villiers-le-Bel
les Carreaux
les Charmettes
le Plessis-Bouchard
les Quartiers
Chau de Boissy
les Grouettes
la Patte d'Oie
les Peupliers
le Gros Noyer
N. 14
N. 328
N. 309
Herblay
le Pavé
la Folie
Ermont
Eaubonne
Soisy-s-Montmorency
Montmorency
Groslay
Sarcelles
les Marronniers
N. 370
Montigny-lès-C.
St Marc
Franconville
Mln du Ru
Cernay
la Cr Rouge
Deuil-la-Barre
Arnouville-lès-Gonesse
Beauséjour
la Dame Blanche
Fort de Stains
Lochères
la Frette-s-S.
Cormeilles-en-Parisis
Sannois
St Gratien
N. 311
la Barre
Montmagny
le Barrage
Pierrefitte-s-S.
l'Avenir
la Lutèce
Garges-lès-G.
24,5
les Tertres
les Picardes
Enghien-les-B.
Mazagran
N. 192
Epinay-s-S.
Villetaneuse
Stains
la Cerisaie
Dugny
Argenteuil
CT
Port de Paris
Romainpourt
Croult
Sartrouville
les Judes
le Val Notre-Dame
Gennevilliers
N. 310
N. 14A
l'Ile-St-Denis
15
N. 186
Villeneuve-la-Garenne
SP
St-Denis
Basque
Le Bourget
les 6 Routes
La Courneuve
Houilles
Bezons
23
20
le Grd Cerf
Pit Colombes
Colombes
les Vallées
Bois-Colombes
Carref Pleyel
12
les 4 Routes
Carrières-s-S.
N. 311A
La Seine
Fl.
Asnières
Aubervilliers
La Garenne-Colombes
Becon-les Bruyères
Clichy
N. 310A
St Ouen
la Plaine St Denis
les 4 Chemins
Chatou
la Folie
Pte de Clignancourt
Pte de la Chapelle
Pte de la Villette
Pte de Pantin
Courbevoie
la Défense
Levallois-Perret
Pantin
Nanterre
21
N. 190
N. 13
Puteaux
Neuilly-s-S.
N. 308
Le Pré-St-Gervais
Les Lilas
Sacré Cœur
Pl. Clichy
Gare St Lazare
Gare du Nord
Gare de l'Est
Rueil-Malmaison
Mt Valérien
Pte Maillot
Pl. de l'Étoile
Suresnes
Bois de Boulogne
N. 185
Élysée
281,2 HAB.
Pl. de la République
Bagnolet
la Malmaison
Buzenval
le Val d'Or
Tr Eiffel
Invalides
Hel de Ville
N. Dame
Pl. de la Bastille
N. 302
Pl. de la Nation
Garches
Montretout
St-Cloud
13,5
Gare de Lyon
Gare d'Austerlitz
Gare Montparnasse
Pte de Vincennes
Vaucresson
N. 307
11,5
Pte de St Cloud
Boulogne-Billancourt
St-Mandé
Marnes-la-Coquette
10
Sèvres
Pte de Versailles
Pl. Denfert-Rochereau
Pl. d'Italie
Pte Dorée
Bois de Vincennes
Ville-d'Avray
N. 307A
N. 187
N. 189
N. 189A
Issy-les-Moulineaux
Vanves
Malakoff
Pte de Châtillon
Pte d'Orléans
Pte d'Italie
Pte de la Gare
Pte de Berry
Charenton-le-Pont
St-Maurice
N. 4
N. 19
Alfort
Bellevue
les Bruyères
Montrouge
Gentilly
La Vache Noire
Le Kremlin-Bicêtre
Ivry-sur-Seine
Alfortville
Meudon
Obsre
Clamart
Châtillon
Chaville
N. 20
N. 7
N. 305
Viroflay
Porchefontaine
Bois de Meudon
Bois de Clamart
Villebon
Bagneux
Arcueil
Vélizy-Villacoublay
N. 306A
Fontenay-aux-Roses
Cachan
Vitry-sur-Seine
Le Plessis-Robinson
Villejuif
le Clos
N. 186
Aérodrome de Villacoublay-Morane
le Plt Clamart

4. (*a*) Immediately north of the 40-metre contour the land rises to a dissected ridge of limestone and gypsum. Find on the map two spot heights indicating this ridge.
   (*b*) Photograph 1 is a view looking north from Notre Dame on the Ile de la Cité. Using the map identify the building dominating this photograph.
   (*c*) The hill dominating Photograph 1 is shown as the Butte of Montmartre. How are buttes created?

5. The limestone and gypsum outcrops have been deeply cut by tributaries of the Seine and Marne. These small streams are now underground, and are used for sewage disposal. The city, however, expanded along these valleys in the past. This is particularly evident in the southwestern part of the map.
   (*a*) Using place names found there, identify one such valley of expansion. Give the elevation of the highlands on each side.
   (*b*) What other land use is extremely important in these valleys?
   (*c*) How is most of the highland in the area utilised?
   (*d*) Frequently this highland was used for the defence of the city. Find evidence of this.

PARIS 2

Cliché I.G.N.

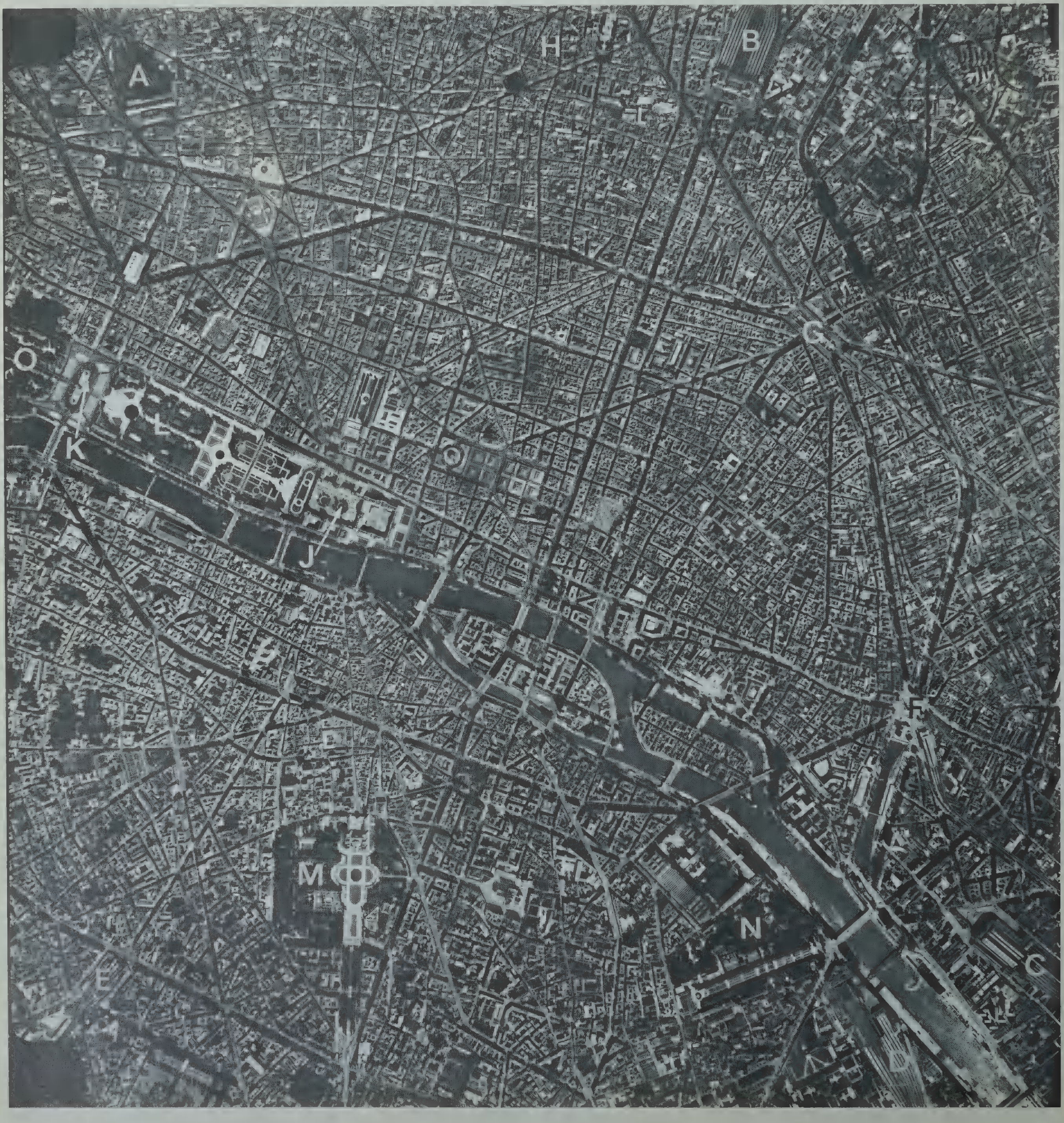


6. (*a*) Paris was originally founded on the Ile de la Cité. Locate this island on the map and Photograph 2. What advantages were available in the choice of this site?
   (*b*) What building and land use dominate the Ile de la Cité today?

7. (*a*) In its infancy Paris, under the Romans, expanded to the south. What advantages were at first attractive in this direction?

PARIS 3

Cliché I.G.N.

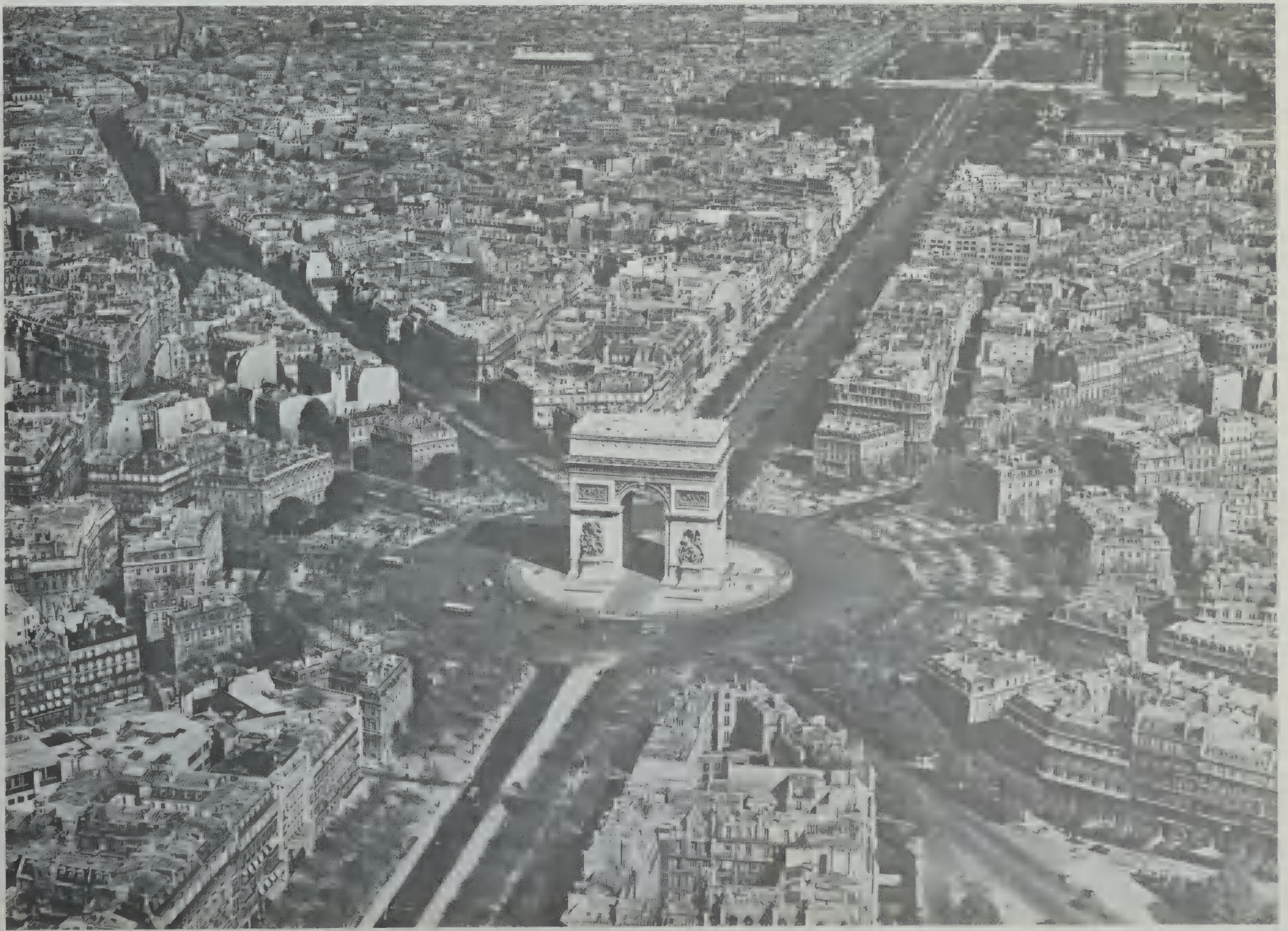


(*b*) Although the Roman settlement withered and died, the land use south of the river created by the Romans and still extant today is basically governmental. However, when Paris became a major river port in the twelfth century the city spread to the north or right bank. What advantage had this location for commercial interests?

(*c*) What types of industry would concentrate around this commercial zone?

8. When Paris became a great industrial city, the port facilities were transferred downstream.
   (*a*) Suggest reasons for this movement.
   (*b*) Locate The Port de Paris.
   (*c*) Is this port on the inside or outside of the meander?
   (*d*) What construction advantages lay in this choice? Refer to the London, England chapter for comparison.
   (*e*) What other form of water communication serves this area? Give the name where possible. At what point do these terminate in central Paris? This terminus is the fruit and vegetable market centre for the city. What more modern form of transportation also terminates here? Find this area on Photograph 3.

PARIS 4



(*f*) Find the number of main rail lines serving the port area.

(*g*) With all these forms of transportation available, especially water, suggest the type of industry most likely to concentrate around the Port de Paris. To substantiate your answer find on an atlas map the closest major ocean port for imports and exports, and the nearest coal field.

9. The centre of Paris is not an area of heavy industry. From a study of Photographs 1, 2, and 3 what effect has this had on:

(*a*) the bridges spanning the river,

(*b*) the type of vessel using the river in this area,

(*c*) river front land use in Central Paris?

(*d*) Compare the situation with that of London, England. Account for the vast differences.

10. On a sketch map of the city show the five functional zones of Paris dealt with:
Ecclesiastical
Government
Business and Commerce
Light industry
Heavy industry

11. Paris has become the major nodal centre for European transportation, particularly rail.

(*a*) Identify the railway terminals shown by the letters A to E on Photograph 3. What station is not shown on Photograph 3? In general, in what parts of Europe would these routes terminate?

(*b*) How has the overall geography of Paris and the basin made Paris a nodal centre for transportation routes?

(*c*) Why are there so many more railway stations in Paris than in similar-sized North American cities?

12. Under Napoleon III, Haussman was employed to plan the city of Paris.

(*a*) From a study of Photograph 4 (the Place de l'Etoile), what was the Haussman plan? Identify the similar patterns at F and G on Photograph 3.

(*b*) How does this plan differ from that of most North American cities?

(*c*) What use was made of the old outer wall of the city?

(*d*) Under the Haussman plan, where were many of the very impressive buildings of Paris constructed? Give examples showing the use of the grand boulevards and the limestone or gypsum buttes.

13. In addition to its other functions, Paris is known as a centre of culture, and is famous for its fine buildings. The Montmartre district, renowned as the art colony of the city, is shown by the letter H on Photograph 3. (See also Photograph 1.) The letter J shows the Louvre, where many famous works of art are housed. The Place de la Concorde, shown by the letter K, commemorates the French Revolution. Paris is also noted for its beautiful gardens and parks. The Tuileries Gardens are L, Luxembourg Gardens are M, and the Jardins des Plantes (botanical gardens) are N. One of the world's most famous streets is the Champs Elysées; the beginning of this street is shown by the letter O. (See also Photograph 4.) Show these locations on the sketch map of the functional zones.

Faculte Saint-Jean (Bibliotheque)
8406 - 91e Rue (St.)
Edmonton, Alberta T6C 4G9

TR 810 B62 1967 c2 FSJ
Blair, Calvin L.,
The Canadian landscape

DATE DE RETOUR
Veuillez rapporter ce volume avant ou
à la dernière date ci-dessous indiquée.

No 16 – "Bibliofiches"

TR 810 B62 1967 c.2
Blair, Calvin L., 1927-
The Canadian landscape; map an
FSJ
0 0004 7745 393

C2291